Clinical practice guidelines for aspiration and pharyngeal residue assessment during eating and swallowing for nursing care: Japan edition

Supervised by the Japan Academy of Nursing Science
(Public Interest Incorporated Association)
Edited by the Nursing Care Development/Standardization Committee

2021 Edition

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Preface

Japan Academy of Nursing Science (JANS) (Public Interest Incorporated Association) was established in 1981 to contribute to society both domestically and internationally for establishing and developing "Nursing Science." In 2017, Prof. Yayoi Kamakura, the former president of JANS, established the "Nursing Care Development/ Standardization Committee." This committee aims to reinforce the foundations of nursing science and create a system that benefits people requiring nursing care in hospitals or communities, through the development and standardization of nursing techniques based on evidence from research results. Prof. Hiromi Sanada was appointed as the first chair of the committee and Prof. Junko Sugama took over as the chair in 2019. The main activity of the committee was the development of a clinical practice guideline for aspiration and pharyngeal residue assessment during eating and swallowing in nursing care. In our guidelines, we decided to focus on the support for basic medical care. In other words, we decided to standardize nursing care techniques for basic human activities, such as sleeping, eating, and excretion, and started with aspiration and pharyngeal residue assessment during eating and swallowing, which are urgent issues that need attention in the older adults.

This clinical practice guideline for aspiration and pharyngeal residue assessment during eating and swallowing for nursing care adopted achievements from one arm of the research project, on the creation of medical arts, of the Japan Agency for Medical Research and Development (AMED) (development of new medical technologies and software, such as surgical, cancer, nursing, and rehabilitation). The AMED research project conducted in 2016–2018 was on the "Establishment of a multi-healthcare professionals' collaboration system to support eating, swallowing, and defecation care in long-term care facilities or home care settings with the introduction of advanced nursing technologies." The chief project leader was Prof. Hiromi Sanada, the chairperson of JANS' board of directors. The former JANS Board of Directors approved this adoption. AMED introduced nursing assessment technologies using ultrasound diagnostic devices or endoscopes and constructed a multi-healthcare professionals' collaboration system with home/long-term care facilities/hospitals using information and communication technologies, with the goal to support the older adults to eat independently until the end of life in their habitual living settings.

This clinical practice guideline on aspiration and pharyngeal residue assessment consists of two parts: Part 1 (Basic characteristics of aspiration and pharyngeal residue during eating and swallowing) and Part 2 (Recommendations for clinical questions and systematic review), in accordance with the "Minds Manual for Guidelines Development 2017" published by the Medical Information Network Distribution Service. The clinical questions and recommendations in Part 2 consist of the technologies developed in AMED and usual physiological assessments and screening tests, focusing on aspiration and pharyngeal residue assessment.

In addition, the development of this clinical practice guideline is also responsible for building a network of researchers and training young researchers. Moreover, young members of JANS have been actively involved in the systematic review process, which is important for the development of clinical practice guidelines, and have provided support for the writing and submission of review articles. Using this guideline development process

as a model, we have already started to develop the next clinical practice guidelines for incontinence and constipation.

We hope that the development of clinical practice guidelines will standardize nursing care and that the evidence will not only promote scientific nursing care but also aid the development of new technologies and further promotion of nursing research.

Finally, we would like to express our gratitude to the contributions of the Supervisory Committee, the Clinical Practice Guideline Development Group, and the Systematic Review Team for their guidance and support to JANS at our first attempt in the development of this clinical practice guideline. We would also like to express our deepest gratitude to the former president of JANS, Prof. Yayoi Kamakura, the Board Members, the supervisors, the related academic societies that reviewed and provided advice at the pre-publication stage, and the members of JANS who contributed their opinions through the public comments feature.

Above all, we hope that this clinical practice guideline will contribute to the management of oropharyngeal dysphagia in the future.

2021 March

President, Japan Academy of Nursing Science
Former Chairperson of the Nursing Care Development and Standardization Committee
Hiromi Sanada

Chairperson of the Nursing Care Development and Standardization Committee
Junko Sugama

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Clinical practice guideline overview

1. Title

Clinical practice guidelines for aspiration and pharyngeal residue assessment during eating and swallowing for nursing care: Japan edition

2. Purpose

The purpose of this clinical practice guideline is to provide and recommend methods of assessing aspiration and pharyngeal residue during eating and swallowing and to select and implement nursing care for adults to prevent the development of aspiration pneumonia through early and appropriate management of oropharyngeal dysphagia.

3. Topic

Assessment of aspiration and pharyngeal residue during eating and swallowing in adults.

4. Expected users and facilities

The users of this clinical practice guideline are assumed to be nurses who manage oropharyngeal dysphagia in cooperation with a wide range of professionals, including physicians, dentists, and speech-language-hearing therapists, in hospitals, nursing homes, and homes.

5. Organization (Figure 1)

"Clinical practice guidelines for aspiration and pharyngeal residue assessment during eating and swallowing for nursing care: Japan edition" development organization was formed by JANS as the main academic society, with three main divisions.

The three main divisions are the Supervisory Committee in the Nursing Care Development/Standardization Committee, Clinical Practice Guideline Development Group, and Clinical Practice Guideline Development Systematic Review Team. The Supervisory Committee was formed in April 2018 to develop this clinical practice guideline and consisted of experts in nursing technology development, gerontological nursing, home care nursing, dysphagia nursing, rehabilitation medicine, medical education, and clinical practice guidelines development

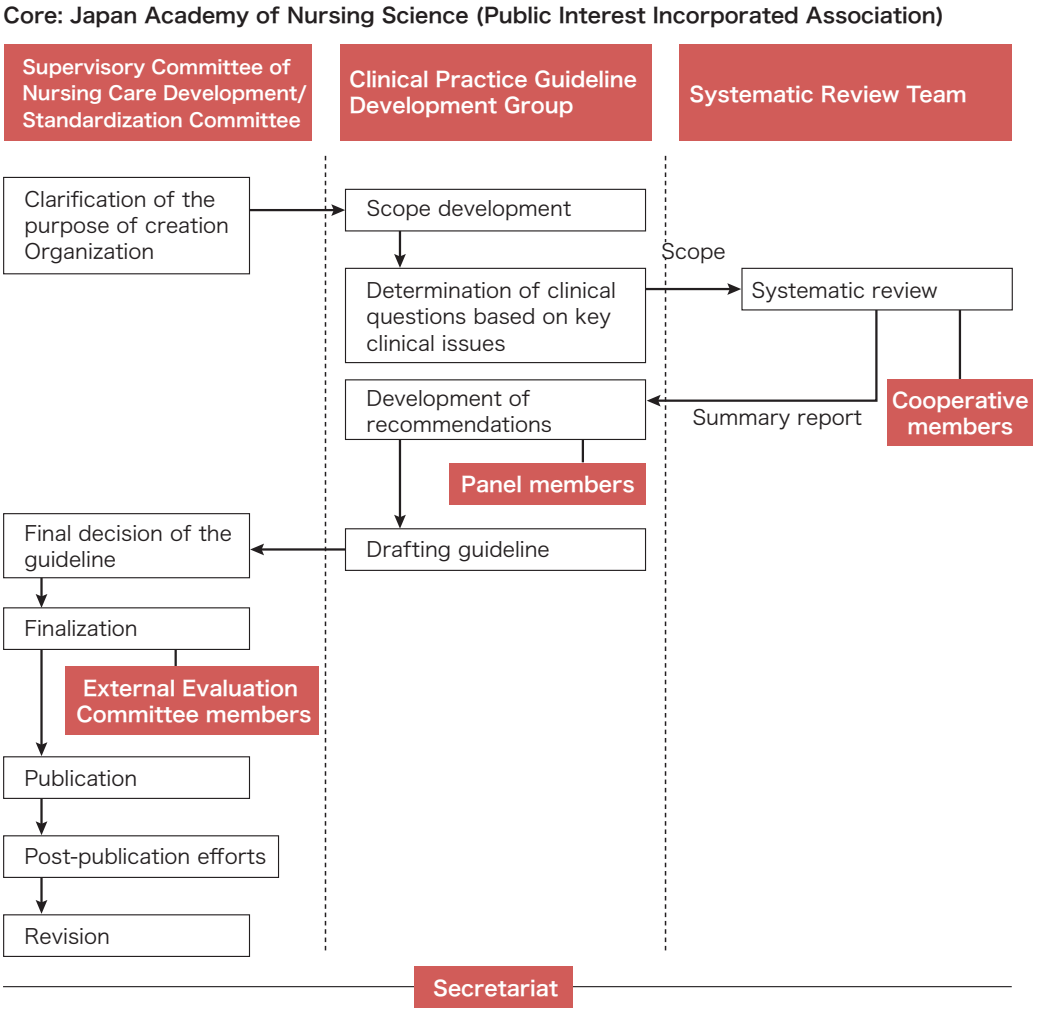

Figure 1: Organizational structure for developing the clinical practice guideline

methodology. The Clinical Practice Guideline Development Group was then formed with experts in nursing technology development, gerontological nursing, home care nursing, dysphagia nursing, rehabilitation medicine, dentistry with expertise in dysphagia care, and systematic reviews with the necessary expertise to develop this guideline. The Systematic Review Team was independent of the Clinical Practice Guideline Development Group, and its members were recommended and appointed by the Supervisory Committee in Nursing Care Development/Standardization Committee in May 2018. The selection criteria for Systematic Review Team members were doctoral degrees, and at least one published original paper for the first author.

In addition to the three divisions, panel members, cooperating members, and a secretariat were also appointed. The panel members were six members from the Clinical Practice Guideline Development Group, including one rehabilitation physician, one dentist, four nurses, and two certified nurses in dysphagia nursing, and one speech-language-hearing therapist from the external cooperating members. Panel members convened in October

2019 and April 2020 to determine the recommendations for the clinical practice guideline development process. A cooperating member was a senior health science information specialist with expertise in the extraction of the literature for the systematic review. A secretariat served as the management organization for all aspects of the clinical practice guideline development.

These organizations included those who were not members of the JANS and were referred to as external cooperating members. After the completion of the draft, external evaluation committee members were selected from external evaluation organizations; they were experts and not a part of the above constituent organizations. The external evaluation committee members were selected from academic organizations in the specialized fields of geriatrics, rehabilitation, home healthcare, and clinical practice guideline development.

6. Members and their roles in the organization

The names, affiliations, locations of affiliations, and roles of each member of the guideline development organization are shown in **Figure 1**, and their roles are listed in the table below.

1) Supervisory Committee members of Nursing Care Development/Standardization Committee (in alphabetical order, except the Chair)

Name	Affiliation	Location	Role
Junko Sugama (Chair)	Research Center for Implementation Nursing Science Initiative, School of Health Sciences, Fujita Health University	Toyoake, Aichi	Expert in nursing technology development
Eiichi Saitoh*	Fujita Health University	Toyoake, Aichi	Expert in rehabilitation medicine
Erika Ota	Global Health Nursing, Graduate School of Nursing Science, St. Luke's International University	Chuo-ku, Tokyo	Expert in clinical practice guideline development
Hiromi Sanada	Department of Gerontological Nursing/Wound Care Management, Graduate School of Medicine, The University of Tokyo	Bunkyo-ku, Tokyo	Expert in gerontological nursing
Masako Yamada	Home Care Nursing, Graduate School of Nursing Science, St. Luke's International University	Chuo-ku, Tokyo	Expert in home care nursing
Miyuki Ishibashi	Department of Frontier Practice Nursing, Graduate School of Nursing, Chiba University	Chiba, Chiba	Expert in gerontological nursing
Takeo Nakayama*	Department of Health Informatics, Graduate School of Medicine, Kyoto University	Kyoto, Kyoto	Expert in clinical practice guideline development
Takeshi Nomura*	Department of Intensive Care Medicine, Tokyo Women's Medical University	Shinjuku-ku, Tokyo	Expert in medical education
Yayoi Kamakura	Japanese Red Cross Toyota College of Nursing	Toyota, Aichi	Expert in dysphagia nursing

* External cooperative members

2) Clinical Practice Guideline Development Group members (in alphabetical order, except the leader and sub-leader)

Name	Affiliation	Location	Role
Junko Sugama (Leader)	Research Center for Implementation Nursing Science Initiative, School of Health Sciences, Fujita Health University	Toyoake, Aichi	Expert in nursing technology development
Gojiro Nakagami (Sub-leader)	Department of Gerontological Nursing/Wound Care Management, Graduate School of Medicine, The University of Tokyo	Bunkyo-ku, Tokyo	Expert in gerontological nursing
Erika Ota	Global Health Nursing, Graduate School of Nursing Science, St. Luke's International University	Chuo-ku, Tokyo	Expert in clinical practice guideline development
Naoko Sato	Chuo Partners Corporation Tokyo Hikari Nurse Station	Chuo-ku, Tokyo	Expert in home care nursing
Junko Fukada	Department of Nursing & Health, School of Nursing & Health, Aichi Prefectural University	Nagoya, Aichi	Expert in dysphagia nursing
Seiko Shibata*	Department of Rehabilitation Medicine I, School of Medicine, Fujita Health University	Toyoake Aichi	Expert in rehabilitation medicine
Takashi Hase*	Department of Oral and Maxillofacial Surgery, Noto General Hospital	Nanao, Ishikawa	Expert in Gerodontology
Tatsuto Miki	Department of Nursing, Fujita Health University Hospital	Toyoake, Aichi	Certified nurse in dysphagia nursing

* External cooperative members

3) Systematic Review Team members (in alphabetical order)

Name	Affiliation	Location	Responsible clinical questions (CQs)
Aya Kitamura	Department of Gerontological Nursing/Wound Care Management, Graduate School of Medicine, The University of Tokyo	Bunkyo-ku, Tokyo	CQs 3,4,5,9
Hiroshi Noguchi	Department of Physical Electronics and Informatics, Graduate School of Engineering, Osaka City University	Osaka, Osaka	CQs 1,7
Itoko Tobita	Graduate School of Medical Safety Management, Jikei University of Health Care Sciences	Osaka, Osaka	CQs 3,4,5,9
Kanae Mukai	Institute of Medical, Pharmaceutical and Health Sciences, Kanazawa University	Kanazawa, Ishikawa	CQs 1,6
Masaru Matsumoto	Department of Imaging Nursing Science, Graduate School of Medicine, The University of Tokyo	Bunkyo-ku, Tokyo	CQs 1,7
Mikako Yoshida	Tohoku University Graduate School of Medicine	Sendai, Miyagi	CQs 2,8,10
Mikiko Arita	Department of Nursing, Osaka Shin-ai College	Osaka, Osaka	CQs 3,4,5,9
Misako Dai	Research Center for Implementation Nursing Science Initiative, School of Health Sciences, Fujita Health University	Toyoake, Aichi	CQs 1,6
Nao Tamai	Department of Imaging Nursing Science, Graduate School of Medicine, The University of Tokyo	Bunkyo-ku, Tokyo	CQs 2,8,10
Tamae Urai	Faculty of Nursing, Toyama Prefectural University	Toyama, Toyama	CQs 3,4,5,9
Toshiaki Takahashi	Global Nursing Research Center, Graduate School of Medicine, The University of Tokyo	Bunkyo-ku, Tokyo	CQs 2,8,10
Yohei Okawa	Tohoku University School of Medicine	Sendai, Miyagi	CQs 8
Yuka Miura	Department of Imaging Nursing Science, Graduate School of Medicine, The University of Tokyo	Bunkyo-ku, Tokyo	CQs 1,6
Yuko Mugita	Department of Gerontological Nursing/Wound Care Management, Graduate School of Medicine, The University of Tokyo	Bunkyo-ku, Tokyo	CQs 2,8,10

4) Panel members (in alphabetical order)

Name	Affiliation	Location	Role
Erika Ota	Global Health Nursing, Graduate School of Nursing Science, St. Luke's International University	Chuo-ku, Tokyo	Expert in clinical practice guideline development
Gojiro Nakagami	Department of Gerontological Nursing/Wound Care Management, Graduate School of Medicine, The University of Tokyo	Bunkyo-ku, Tokyo	Expert in gerontological nursing
Junko Fukada	Department of Nursing & Health, School of Nursing & Health, Aichi Prefectural University	Nagoya, Aichi	Expert in dysphagia nursing
Junko Sugama	Research Center for Implementation Nursing Science Initiative, School of Health Sciences, Fujita Health University	Toyoake, Aichi	Expert in nursing technology development
Masako Kurachi*	Department of Speech, Language and Hearing Sciences, Graduate School of Health and Welfare Sciences, International University of Health and Welfare	Narita, Chiba	Speech-language-hearing therapist
Naoko Sato	Chuo Partners Corporation Tokyo Hikari Nurse Station	Chuo-ku, Tokyo	Expert in home care nursing
Seiko Shibata*	Department of Rehabilitation Medicine I, School of Medicine, Fujita Health University	Toyoake Aichi	Expert in rehabilitation medicine
Takako Shirasaka	Day Service Try Asu	Sakura, Chiba	Certified nurse in dysphagia nursing
Takashi Hase*	Department of Oral and Maxillofacial Surgery, Noto General Hospital	Nanao, Ishikawa	Expert in gerodontology
Tasuto Miki	Department of Nursing, Fujita Health University Hospital	Toyoake, Aichi	Certified nurse in dysphagia nursing
Yukiko Yamane*	Graduate School of Nursing Science, Asahikawa Medical University	Asahikawa, Hokkaido	Certified Nurse in dysphagia nursing

*External cooperative members

5) Cooperative members

Name	Affiliation	Location	Role
Takaaki Suzuki*	Nara Medical University Library	Kashihara, Nara	Japan Medical Library Association Health Sciences Information Professional, distinguished

*External cooperative member

6) Secretariat

Name	Affiliation	Location
Misako Dai	Research Center for Implementation Nursing Science Initiative, School of Health Sciences, Fujita Health University	Toyoake, Aichi

7) External Evaluation Committee members (alphabetical order)

Name	Affiliation	Location	Specialty	Academic organization which recommended the member
Eishu Nango	Seibo International Catholic Hospital/ Cochrane Japan	Shinjuku-ku, Tokyo	Clinical practice guideline development	Cochrane Japan
Itaru Takehara	Tokyo Metropolitan Rehabilitation Hospital	Sumida-ku, Tokyo	Dysphagia rehabilitation	The Japanese Society of Dysphagia Rehabilitation
Norio Watanabe	Soseikai General Hospital / Cochrane Japan	Kyoto, Kyoto	Clinical practice guideline development	Cochrane Japan
Ritsuko Yamada	School of Nursing and Social Services, Health Sciences University of Hokkaido	Ishikari, Hokkaido	Geriatric nursing	Japan Academy of Gerontological Nursing
Satoru Ebihara	Department of Rehabilitation Medicine, Graduate School of Medicine, Toho University	Ota-ku, Tokyo	Geriatric medicine	The Japan Geriatrics Society
Shingo Okada	Kitamihara Clinic	Hakodate, Hokkaido	Home health care	Japanese Association for Home Care Medicine
Takumi Itagaki	Center for Nursing Practice and Education, Gunma Paz University	Takasaki, Gunma	Rehabilitation nursing	Japan Rehabilitation Nursing Academy
Yasuyo Tanaka	Nursing Home Kino Sato	Toyohashi, Aichi	Home care nursing	Japan Academy of Nursing for Home Care

7. Conflict of Interest (COI)

Types of COIs considered: Economic and academic COIs were declared.

Method of investigation of potential COIs: COI declarations were made in accordance with the clinical practice guidelines of the Japan Academy of Nursing Science.

The status of COIs for each participant in the development of the clinical practice guideline for the past three years, dating back to the time of publication of the clinical practice guidelines, is shown in the appendix at the end of this clinical practice guideline.

Description of economic COIs: directorships and advisory positions (1 million JPY or more), stock ownership (profits of 1 million JPY or more, 5% or more of all shares), royalties from patent rights (1 million JPY or more), lecture fees (500,000 JPY or more), manuscript fees (1 million JPY or more), research expenses from companies and organizations (2 million JPY or more), scholarship donations (incentive donations), endowed chairs (affiliations), and other remuneration (100,000 JPY or more) related to this clinical practice guideline were requested to be declared.

Description of academic COI: We asked experts from multiple fields and professions to participate as members of the Clinical Practice Guideline Development Group or Systematic Review Team, and proceeded with the development of this clinical practice guideline while striving to eliminate the influence of specialization, intention, academic development, and inter-organizational competition of individuals or professional societies. We asked the members to declare the following condition: being involved as a member in the development of other clinical practice guidelines or their equivalents related to this clinical practice guideline.

When starting the preparation of this clinical practice guideline, all committee members were asked to submit a COI declaration form, and all committee members confirmed that they had no conflicts of interest that would affect the preparation of this clinical practice guideline. The authors of the literature covered by the systematic review (including both first and co-authors) were excluded from the panel meetings when determining the Systematic Reviesresponsibilities and recommendations for the corresponding clinical questions (CQs). In addition, we requested the submission of COI declarations in different fiscal years and looked for any changes.

8. Clinical practice guideline development method

1) Development policy

Individuals with dysphagia are widely distributed in hospitals, nursing homes, and homes. Common problematic disorders in people with dysphagia are aspiration, in which food enters the trachea, and pharyngeal residue, in which food is stored in the pharynx. These can lead to choking and aspiration pneumonia, which threaten the lives of the people. In contrast, emphasizing heavily on safety and restricting oral intake leads to a loss of enjoyment of eating and a decrease in the quality of life of the people. In Japan, multidisciplinary cooperation among physicians, dentists, nurses, speech-language-hearing therapists, physical therapists, occupational therapists, and care workers has led to the implementation of dysphagia rehabilitation to help people with aspiration and pharyngeal residue during eating and swallowing to eat safely by mouth. Nurses are expected to help people with aspiration and pharyngeal residue while eating and swallowing to maintain or restore their eating function in their daily lives. To support the maintenance and restoration of eating and swallowing functions, clinical practice guidelines that can be used in any setting, whether in hospitals, at facilities, or at home, and that guide the selection of management of oropharyngeal dysphagia provided in collaboration with physicians and other multidisciplinary professionals are needed. In particular, patients receiving care at home and in institutions have limited opportunities to undergo swallowing videofluoroscopy (VF) and videoendoscopy (VE) by physicians, and nurses are required to collaborate with their physicians, rehabilitation physicians, and other multidisciplinary professionals to conduct assessments. In addition, in recent years, research and educational programs on the use of ultrasound diagnostic devices and endoscopes for nurses to observe aspiration and pharyngeal residues have become more widespread. Hence, there is a need for standardized guidelines on how to use these devices for dysphagia care.

Correspondingly, we have developed this clinical practice guideline in accordance with the Minds Manual for Guideline Development 2017, to provide a specific pathway for making decisions on care selection policies based on research evidence and multifaceted factors, such as the balance between benefits and harms and patients' values. The CQs were framed for actual situations encountered while choosing dysphagia care, especially in cases that are difficult to judge and where improvement of clinical outcomes are sought. Recommendations were determined by panel members from various positions involved in the decision-making process. These guidelines have been developed to ensure neutrality and transparency.

Since this clinical practice guideline is based on the flow of medical treatment for people with aspiration and pharyngeal residue during eating and swallowing in Japan, and the main users of VFs and VEs overseas may differ from those in Japan, we hereby explain the implementation of VF and VE in the United States (U.S.) and

Europe as examples. In the U.S., speech-language pathologists (SLPs) perform screening tests and detailed examination and evaluation of aspiration and pharyngeal residue during eating and swallowing at the request of physicians. Although laws vary by state, SLPs are often in charge of performing VFs and VEs for diagnosis in the U.S. In Europe, educational programs have been developed in recent years, and SLPs are now in charge of VEs, but until now, physicians were often in charge of VEs, as is the case in Japan. Systematic reviews of CQs were based on the literature search for both English and Japanese articles, and the recommendations were based on a wide range of evidence from overseas. However, it is necessary to keep in mind the differences in medical systems between Japan and overseas when using the clinical practice guidelines.

2) Development process (Figure 2)

This clinical practice guideline was developed in accordance with the Minds Manual for Guideline Development 2017, which adopts the strength of evidence classification proposed by the GRADE (Grading of Recommendations Assessment, Development and Evaluation) system, which is widely used internationally.

(1) Structure of the guideline development organization

After JANS clarified the purpose of creating this clinical practice guideline, a Supervisory Committee was formed, and the drafting of the clinical practice guidelines was initiated. In April 2018, in accordance with the Minds Manual for Guideline Development 2017, a Clinical Practice Guideline Development Group was formed, a secretariat was established, a Systematic Review Team was formed, and cooperating members were determined.

(2) Development of scope

After the overall scope development policy was decided by the Supervisory Committee, the Guideline Development Group organized the basic characteristics of the disease (aspiration and pharyngeal residue during eating and swallowing) and selected candidates for CQs. The selected CQ candidates were further narrowed down to ten CQs in October 2018 under the supervision of the Supervisory Committee, and for each of the shortlisted CQs, rules related to systematic reviews were determined. The rules include the method of search of evidence (type of evidence, database, search method, period of search), criteria for selection and exclusion of literature, and the method of integration of the results of evidence evaluation. After these steps, the scope was determined. Following the basic characteristics of aspiration and pharyngeal residue during eating and swallowing and the algorithm for selecting the management options for oropharyngeal dysphagia, three main items were determined as the specific content of the scope (items related to the content covered by the clinical practice guideline, items related to the SR, and items related to the process of making recommendations for finalization and publication). The first item included the title, purpose, topic, expected users, relationship to existing clinical practice guidelines, key clinical issues, scope of the clinical practice guidelines, and CQ list. The second item, systematic reviews, included the review schedule, evidence search, literature selection criteria, inclusion and exclusion criteria, and methods of evidence evaluation and synthesis. The third item, from recommendation development to finalization and publication, included the basic policy of recommendation development, finalization, specific methods of external evaluation, and the publication schedule.

(3) Systematic review

Systematic Review Team members were appointed and requested to conduct a systematic review of each CQ from May 2018. While collecting evidence, a search was conducted based on the scope with the help of a Health Sciences Information Professional, distinguished, for determining search formulas and performing literature

Figure 2: Guideline development process

search. After the primary and secondary screening, the pieces of evidence were individually assessed qualitatively by systematic review and were collectively used as evidence. These pieces of evidence were summarized for the overall assessment of the body of evidence. Based on the results, systematic review reports were prepared; qualitative synthesis was used as the basis in accordance with the Minds Manual for Guideline Development 2017.

However, a quantitative synthesis (meta-analysis) was performed for some CQs because they had multiple studies with similar evaluation methods. The systematic reviews were completed in September 2019.

A. Evidence searches

ⅰ. Type of evidence

Individual articles: randomized controlled trials, non-randomized controlled trials, and observational studies

Review articles: systematic reviews

Existing guidelines: In scoping and setting CQs, the Guidelines for the Treatment of Dysphagia (September 2018) and Guidelines for the Treatment of Adult Pneumonia (April 2017) were used as references. In the systematic review, we did not use the results of these existing clinical practice guidelines but conducted a new systematic review of all of them.

ⅱ. Database

PubMed, Embase, CINAHL, Cochrane Library, Ichushi-Web (Japanese)

ⅲ. Searching method

The patient, intervention, control, and outcome (PICO) format was used to search for interventions based on a combination of P, I, and study design, sometimes specifying C. O was not specified.

ⅳ. Searching period

All articles included in the databases before the end of August 2019.

B. Inclusion and exclusion criteria of articles

Of the existing clinical practice guidelines or systematic review articles addressing the same clinical questions as this guideline, none were developed in accordance with the Minds Manual for Guideline Development 2017; therefore, all of them were subjected to a new systematic review. In the case of CQs on care choice interventions, priority was given to systematic reviews which included randomized controlled trials that met the recruitment criteria; however, observational studies were included even if there were no randomized controlled trials that met the inclusion criteria. In the case of the CQs on the sensitivity and specificity of assessment for care selection, cross-sectional observational studies that met the inclusion criteria were included.

C. Evidence evaluation and synthesis of the results

The evaluation method and method of expressing the strength of the body of evidence conformed to the Minds Manual for Guideline Development 2017. Although a qualitative synthesis was the basic method, quantitative synthesis (meta-analysis) was conducted for CQ1, CQ6, and CQ7 because they included several studies with similar evaluation methods.

(4) Development of recommendations

The basic policy for the development of the recommendations was based on the Minds Manual for Guideline Development 2017, with particular attention given to incorporating the perspectives of non-nurses by adding physicians, dentists, and speech-language-hearing therapists as members of the recommendation panel. The recommendation panel consisted of four nurses, one rehabilitation physician, and one dentist from the Clinical Practice Guideline Development Group, and one nurse and one speech pathologist as cooperating committee members. Panel meetings were held in October 2019 and April 2020 to decide the recommendations. The recommendations were decided by a two-thirds majority vote of the panel members on the draft recommendations prepared by the Guideline Development Group in accordance with the modified Delphi method. If a decision could not be achieved through voting, the status was set to "no recommendation." Health care costs and resource use were not included in the outcomes but were assessed at the stage of the recommendation decision.

Table 1: Certainty (strength) of evidence on the overall outcome for making recommendations/ decisions

A (Strong)	Strong confidence in the appropriateness of the effect estimate to support recommendations.
B (Moderate)	Moderate confidence in the appropriateness of the effect estimate to support recommendations.
C (Weak)	Limited confidence in the appropriateness of effect estimate to support recommendations.
D (Very weak)	Little confidence in the appropriateness of the effect estimate to support recommendations.

(According to Minds Manual for Guideline Development 2017, p.101)

Table 2: Strength of recommendations and how recommendations are stated.

(1) How to describe the strength of the recommendation? Strength of recommendation "1": Strongly recommended Strength of recommendation "2": Weakly recommended (suggested) (Strength of recommendation "None": No clear recommendation can be made)
(2) How to write a recommendation statement? The recommendation statement should be written as follows, with the strength of evidence (A, B, C, or D) added to the strength of recommendation (1), as mentioned above. 1) It is recommended to perform care selection "I" for patient P (1A) = (Strong recommendation, strong certainty of evidence) 2) It is recommended to conditionally perform care selection "I" for patient P (2C) = (Weak recommendation, weak certainty of evidence) 3) It is suggested not to perform care selection "I" for patient P (2D) = (Weak recommendation, very weak certainty of evidence) 4) It is strongly recommended not to perform care selection "I" for patient P (1B) = (Strong recommendation, moderate certainty of evidence)

(According to Minds Manual for Guideline Development 2017, p.173)

The meeting members decided on the recommendations based on the strength of evidence for all outcomes for CQ (**Table 1**); the balance of benefits and harms; other factors, such as patient values and preferences; burden; and medical costs and resources, which were taken into account in a comprehensive manner. The strength of the recommendation was classified as 1: strongly recommended or 2: weakly recommended (suggested), and the certainty of the evidence (strength) was listed together (**Table 2**). In cases where no clear recommendation could be made, "None" was selected.

(5) Finalization

The first draft was peer-reviewed by the Clinical Practice Guideline Development Group members in November 2020. After the completion of the draft in December 2020, it was validated by the Supervisory Committee in January 2021, and external evaluations were conducted and public comments were collected in February 2021. The Clinical Practice Guideline Development Group examined the results of the external evaluation and public comments, revised the content based on the results, and reached a consensus in an online meeting in March 2021. After considering the external evaluations and public comments, the Supervisory Committee of the Nursing Care Development/Standardization Committee finalized the guidelines in March 2021, and the guidelines were published in June.

9. Clinical questions and summary of recommendations

1) Focused assessment

The assessments covered in this clinical practice guideline include physical assessment, Repetitive Saliva Swallowing Test (RSST), Modified Water Swallowing Test (MWST), Food Test (FT), cervical auscultation, and observations using an ultrasound diagnostic device and an endoscope.

2) List of important clinical topics, clinical questions, and recommendations

Important clinical topics 1

For adults with dysphagia, is it useful to conduct a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) to assess aspiration and pharyngeal residues during eating and swallowing?

CQ 1

It is advisable to perform a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia? To avoid duplication with CQs 3, 4, 5, and 6, assessments using only the Repetitive Saliva Swallowing Test (RSST), Modified Water Swallowing Test (MWST), Food Test (FT), or cervical auscultation were not included here.

Recommendations

○We propose to conduct an assessment of aspiration through a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) for individuals aged 18 years and older, who are suspected of having dysphagia.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] When including observation items that require an understanding of instructional actions, such as command swallowing of water, care should be taken while applying the process to persons with impaired consciousness or severe cognitive impairment.

CQ 2

Is it advisable to manage oropharyngeal dysphagia based on a systematic assessment using physical assessment techniques (interview, visual inspection, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia. To avoid duplication with CQs 3, 4, 5, and 6, assessments using only Repetitive Saliva Swallowing Test (RSST), Modified Water Swallowing Test (MWST), Food Test (FT), or cervical auscultation were not included here.

Recommendations

○We propose to manage oropharyngeal dysphagia based on a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] Subsequent screening and diagnostic tests based on a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) are necessary for the implementation of appropriate care.

Important clinical topics 2

What aspiration and pharyngeal residue screening tests are useful for adults with dysphagia to perform aspiration and pharyngeal residue assessments during eating and swallowing?

CQ 3

Is it advisable to screen for aspiration by Repetitive Saliva Swallowing Test (RSST) in persons over 18 years of age suspected of having dysphagia?

Recommendations

○We suggest that individuals aged 18 years and older, who are suspected of having dysphagia, should be screened for aspiration using Repetitive Saliva Swallowing Test (RSST).

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] Repetitive Saliva Swallowing Test (RSST) requires movement with an understanding of instructions, and caution should be exercised regarding its application to persons with impaired consciousness or severe cognitive impairment. Caution should be exercised when applying Repetitive Saliva Swallowing Test (RSST) to patients with xerostomia. Patients with Parkinson's syndrome, who have strong immobility and inactive, are often judged to be abnormal, regardless of their swallowing function.

CQ 4

Is it advisable to screen for aspiration using the Modified Water Swallowing Test (MWST) in persons over 18 years of age, who are suspected of having dysphagia?

Recommendations

○We suggest screening for aspiration with the MWST in individuals aged 18 years and older, who are suspected of having dysphagia.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] To prevent aspiration of oral bacteria, the mouth should be cleaned before per-

forming the procedure; Modified Water Swallowing Test (MWST) requires movement with an understanding of instructions, and caution should be exercised regarding its application to persons with impaired consciousness or severe cognitive impairment.

CQ 5

Is it advisable to screen for aspiration by FT (Food Test) for persons over 18 years of age, who are suspected of having dysphagia?

Recommendations

○ It is suggested to screen individuals aged 18 years or older suspected of having dysphagia for aspiration using FT (Food Test).

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] To prevent aspiration of oral bacteria, the mouth should be cleaned before performing the procedure; FT (Food Test) requires movement with an understanding of instructions, and care should be taken regarding its application to persons with impaired consciousness or severe cognitive impairment.

CQ 6

Is it advisable to screen for aspiration and pharyngeal residues by cervical auscultation in persons aged 18 years or older, who are suspected of having dysphagia?

Recommendations

○ Screening for aspiration and pharyngeal residues swallowing by cervical auscultation should be performed in individuals aged 18 years and older, who are suspected of having dysphagia.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] Education on screening for aspiration and pharyngeal residues is needed for nurses who perform cervical auscultation.

CQ 7

For persons over 18 years of age suspected of having dysphagia, is it advisable for a nurse who has undergone an educational program to screen for aspiration and pharyngeal residues by observation with an ultrasound diagnostic device?

Recommendations

○ We propose that persons aged 18 years or older, who are suspected of having dysphagia, receive training in aspiration and pharyngeal residue observation using an ultrasound diagnostic device, and that persons who have been certified by

their instructors as being at a level where they can practice aspiration and pharyngeal residue observation techniques using ultrasound diagnostic devices are screened for aspiration using ultrasound diagnostic devices in facilities and home-visit nursing agencies equipped with ultrasound diagnostic devices.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] A device connected to a linear probe should be provided. The probe should have a bandwidth in the frequency range of 5–15 MHz. The resolution of the instrument should be at a level that can clearly delineate the contours of the thyroid cartilage and epiglottis.

CQ 8

For individuals over 18 years of age, who are suspected of having dysphagia, is it acceptable for nurses, who have undergone an educational program, to manage oropharyngeal dysphagia based on observations with an ultrasound diagnostic device and conventional methods?

Recommendations

○ We propose that persons over 18 years of age, who are suspected of having dysphagia, receive training in aspiration and pharyngeal residue observation using ultrasound diagnostic devices, and that persons, who have been certified by their instructors as being at a level where they can practice aspiration and pharyngeal residue observation using ultrasound diagnostic devices, provide management of oropharyngeal dysphagia based on observations using ultrasound diagnostic devices in facilities and offices equipped with these devices. In facilities and offices equipped with ultrasound diagnostic devices, we propose to manage oropharyngeal dysphagia based on observations using these devices.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] A device connected to a linear probe should be provided. The probe should have a bandwidth in the frequency range of 5–15 MHz. The resolution of the instrument should be at a level that can clearly delineate the contours of the thyroid cartilage and epiglottis.

Important clinical topics 3

Is it useful for nurses to observe aspiration and pharyngeal residue using an endoscope to perform aspiration and pharyngeal residue assessment during eating and swallowing in adults with dysphagia?

CQ 9

For persons over 18 years of age, who are suspected of having dysphagia, should a nurse who has undergone an educational program observe aspiration and pharyngeal residue using an endoscope?

Recommendations

○This is an area where evidence is expected to accumulate with the development of future research, and research should be planned in a well-considered clinical environment. Certified nurses in dysphagia nursing and nurses with specialized knowledge and experience in eating and swallowing, who have received training in the endoscopic observation of aspiration and pharyngeal residue and who have been certified by a medical advisor as being able to practice the observation technique, can perform endoscopic observation of aspiration and pharyngeal residue in clinical settings.

GRADE **None** (strength of recommendation： **None**, quality of evidence (strength)：**weak**)

CQ 10

Should the management of oropharyngeal dysphagia for persons aged 18 years or older and suspected of having dysphagia be based on endoscopic observation of aspiration and pharyngeal residue by nurses (who have undergone an educational program) in addition to conventional management?

Recommendations

○This is an area where evidence is expected to accumulate with the development of future research, and research should be planned in a well-considered clinical environment. Certified nurses in dysphagia nursing and nurses with specialized knowledge and experience in the field of dysphagia, who have received training in the endoscopic observation of aspiration and pharyngeal residue and who have been certified by a supervising physician as being able to practice observation techniques, can manage oropharyngeal dysphagia.

GRADE **None** (strength of recommendation： **None**, quality of evidence (strength)：**weak**)

10. Glossary of technical terms

1) Important words

Physical assessment

In this clinical practice guideline, physical assessment is defined as a method of assessing the eating and swallowing function from daily observations and is based on the integration of subjective and objective information. Subjective information was obtained from interviewing the patient and his/her family regarding medical history, eating and swallowing functions from preceding to esophageal phases, and the patient's general condition, including breathing and nutritional status. Objective information was obtained from physical assessments, including interviews, visual, palpatory, auscultation, and percussion examinations of the cerebral nervous system (mainly olfactory, optic, trigeminal, facial, glossopharyngeal, vagus, accessory, and hypoglossal nerves), respiratory system, nutritional status related to eating and swallowing, facial appearance, speech, lips, temporomandibular joint and oral cavity, tongue, soft palate, anterior palatal arch, oral sensation, larynx, trachea, lungs, and general condition.

Pyriform fossa (pyriform sinus)

The pyriform fossa (pyriform sinus) is a groove located between the laryngeal folds and the thyroid cartilage plate. This is where food boluses and fluids pass as they move from the oral cavity to the esophagus; however, if there is a swallowing dysfunction, food boluses and fluids may accumulate in the pyriform fossa (pyriform sinus). In this clinical practice guideline, the term "pyriform fossa," which is the name used in the certified nurse in dysphagia nursing educational program, will be used.

2) List of abbreviations (Table 3)

The abbreviations used in this clinical practice guideline are listed below.

Table 3: List of abbreviations

Abbreviation	Terms
AMED	Japan Agency for Medical Research and Development
CI	Confidence interval
CQ	Clinical question
CT	Computed tomography
DSS	Dysphagia Severity Scale
EAT-10	Eating Assessment Tool-10
ESS	Eating Status Scale
FILS	Food Intake Level Scale
FOIS	Functional Oral Intake Scale
FT	Food Test
ICC	Intraclass correlation coefficient
MASA	The Mann Assessment of Swallowing Ability
MWST	Modified Water Swallowing Test
PAS	Penetration-Aspiration Scale
RSST	Repetitive Saliva Swallowing Test
TOR-BSST	The Toronto Bedside Swallowing Screening Test
US	Ultrasonography
VE	Videoendoscopic examination of swallowing
VF	Videofluoroscopic examination of swallowing

(abbreviations listed in alphabetical order).

11. Scope covered by the clinical practice guideline and precautions for use

This clinical practice guideline covers aspiration and pharyngeal residue assessment during eating and swallowing performed as a nursing task. Aspiration and pharyngeal residue assessment during eating and swallowing by non-nursing professionals and aspiration assessment that occurs in situations other than eating and swallowing (e.g., during sleep) are outside the scope of this document.

This clinical practice guideline was intended for adults (18 years of age and older) suspected of having dysphagia in hospitals, nursing homes, and homes. It should be noted that the goal of eating and swallowing rehabilitation for adults who have experienced oral intake is to restore function, whereas the goal for pediatric patients with eating and swallowing disorders is to acquire eating and swallowing functions. In addition, pediatric patients differ from adults in that they require rehabilitation tailored to their level of development, taking into account their growth and development. Therefore, the scope of this clinical practice guideline is limited to adults. Gender was not a limitation. Although the severity of dysphagia, causative diseases, and comorbidities are not limited, some assessment methods need to be carefully applied. Specifically, when using a physical assessment, if it includes observations that require an understanding of the indicated actions, such as fluid swallowing, care should be taken when applying it to patients with impaired consciousness or severe cognitive impairment. RSST, MWST, and FT should also be used with caution in persons with impaired consciousness or severe cognitive impairment. In addition, when using RSST, care must be taken when applying it to patients with xerostomia. In the case of swallowing observation using an ultrasound diagnostic device and/or an endoscope, the facility or office must have a device capable of making swallowing observations and someone who is adept at using the observation technique and can conduct an appropriate assessment.

12. Relationships between existing clinical practice guidelines

There are no national or international clinical practice guidelines for the assessment of aspiration and pharyngeal residue during eating and swallowing in adults that have been developed for use by nurses for care selection. In Japan, the Japanese Respiratory Society published "The Japanese Respiratory Society guidelines for the management of pneumonia in adults 2017" [1] and the Oto-Rhino-Laryngological Society of Japan published the "Clinical practice guidelines for the diagnosis and management of dysphagia 2018 editions" [2] as medical treatment guidelines for physicians. In addition, the Medical Review Committee of the Japanese Society of Dysphagia Rehabilitation published a manual titled "evaluation of eating and swallowing disorders 2019"[3] for physicians, dentists, nurses, speech-language-hearing therapists, and professionals from other disciplines. The clinical practice guidelines primarily address screening tests and diagnostic evaluation tests such as VF and VE, and the manual covers physical assessment, screening tests, cervical auscultation, and tests for diagnostic evaluation. However, they include no description of the observation of aspiration and pharyngeal residues by ultrasound diagnostic devices or endoscopes performed by nurses. "The guidelines for tongue function testing methods as a diagnostic aid in dysphagia rehabilitation" published by the Japanese Society of Gerodontology[4] discusses ultrasonography, but focuses on the evaluation of tongue movement during mastication and swallowing. In countries

other than Japan, best practices for the assessment of dysphagia and swallowing by nurses have been published; however, they do not describe the observation of aspiration and pharyngeal residue by ultrasound diagnostic devices or endoscopes performed by nurses.

Some of the existing clinical practice guidelines, manuals, and best practices describe physical assessment, screening tests, cervical auscultation, and VE. This clinical practice guideline was developed with these existing publications as references and provides decision support for nurses regarding aspiration and pharyngeal residue assessment during the management of oropharyngeal dysphagia.

References

1. The Japanese Respiratory Society. The Japanese Respiratory Society guidelines for the management of pneumonia in adults 2017. The Japanese Respiratory Society, Tokyo, 2017.
2. The Oto-Rhino-Laryngological Society of Japan. Clinical Practice Guidelines for the Diagnosis and Management of Dysphagia 2018. Kanehara Shuppan, Tokyo, 2018.
3. The Japanese Society of Dysphagia Rehabilitation, Medical Review Committee. Evaluation of Feeding and Swallowing Disorders 2019.
4. The Japanese Society of Gerodontology. Guidelines for tongue function testing methods as a diagnostic aid in dysphagia rehabilitation. 2013.

13. Results of external evaluation and their reflection in the clinical practice guideline

This clinical practice guideline underwent external evaluation by representative academic professionals specializing in geriatric medicine, geriatric nursing, dysphagia rehabilitation, rehabilitation nursing, home health care, and home nursing, as well as by experts on how to develop clinical practice guidelines, during the drafting stage, prior to its publication.

Academic societies of representatives specializing in geriatric medicine, gerontological nursing, dysphagia rehabilitation, rehabilitation nursing, home health care, and home nursing were invited to evaluate and comment freely on the entire draft from the perspective of including the clinical significance and practice. The international standard tool AGREEII[1)] was used by two experts in the development of the clinical practice guideline. AGREEII consists of 23 individual items in six domains and an overall assessment. Each item was scored from 1 to 7, and the average of the values scored by the two experts for each domain was calculated.

The results of the external evaluation have been reflected in this guideline as much as possible. The parts that could not be reflected have been considered in the next revision.

The comments and average scores attached to the AGREE II evaluation are listed below (**Table 4**).

References

1. EBM Medical Information Department, Japan Health Care Organization: Agreement II Japanese translation enforcement version https://minds4.jcqhc.or.jp/minds/guideline/pdf/AGREE2jpn.pdf (Accessed December 2020) (in Japanese)

Table 4: Summary of the results of AGREEII's external evaluation of the pre-publication draft

Domain	Item	Comments	Average
Domain 1. Scope and Purpose	1. The overall objective(s) of the guideline is (are) specifically described.	The purpose described in the outline states "to prevent ... by assessment", but "by showing and recommending how to select and implement assessment and nursing care" is more accurate in terms of the role of the guideline.	5.5
	2. The health question(s) covered by the guideline is (are) specifically described.		6.5
	3. The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described	The target population is considered to be adult patients with dysphagia and adult patients who may have dysphagia, but it is unclear whether the recommendations differ depending on the causative disease or whether a specific causative disease is assumed.	6
Domain 2. Stakeholder Involvmenet	4. The guideline development group includes individuals from all the relevant professional groups.	It is good that the panelists include not only nurses but also physicians, dentists, and speech-language-hearing therapists, but the proportion of nurses is large and it is expected that patients and their families are also included.	6
	5. The views and preferences of the target population (patients, public, etc.) have been sought.	The recommendation panel focuses on the strength of all outcome evidence for CQ (Table 1), the balance between benefits and harms, and comprehensively considers the values, preferences, burdens, medical costs and resources of the caregiver. However, there is a CQ for which there is no description that examines the values of the recuperator in each CQ.	3.5
	6. The target users of the guideline are clearly defined.	Although it is generally described, among the five factors of downgrade, inaccuracies and publication bias are summarized in others, thus it is unclear whether all CQs have been assessed for those points (Stated in the evaluation sheet of evidence but not in the body text). In CQ7 and 8, the supporting evidence seems to be an evaluation using an ultrasound diagnostic device by a physician, whereas the recommendation is for its use by a nurse, so it should be considered whether the evidence will be downgraded in terms of indirectness.	7
Domain 3. Rigour of Development	7. Systematic methods were used to search for evidence	In the "developement process", it is stated that the modified Delphi method was used in making the recommendation decision, but what kind of discussion was made at the panel meeting at each CQ and the result of the vote are not shown.	7
	8. The criteria for selecting the evidence are clearly described.	The criteria seem to vary among the CQs in some extent, however there are no descriptions for each CQ.	6
	9. The strengths and limitations of the body of evidence are clearly described.		5
	10. The methods for formulating the recommendations are clearly described.		5.5
	11. The health benefits, side effects, and risks have been considered in formulating the recommendations.		6.5
	12. There is an explicit link between the recommendations and the supporting evidence.		7
	13.The guideline has been externally reviewed by experts prior to its publication.		7
	14. A procedure for updating the guideline is provided.	There is no description regarding the update of the guidline except for update period.	6
Domain 4. Clarity of Presentation	15. The recommendations are specific and unambiguous.	There is a difference in the length of the recommendations depending on the CQ, and the long one also explains the background of the CQ. I think it would be good if you could simplify the recommendations. Although the target of this clinical practice guideline is nurses, it seems strange to add "Nurses who have received an educational program" only for the recommendations of CQ9 and CQ10. Shouldn't CQ7 and CQ8 be done by "educated nurses" as well?	5.5
	16. The different options for management of the condition or health issue are clearly presented.	It was unclear.	6
	17. Key recommendations are easily identifiable.		7
Domain 5. Applicablity	18. The guideline describes facilitators and barriers to its application.	The factors seem to be different for each CQ, but only a brief description of each method as a whole.	6
	19. The guideline provides advice and/or tools on how the recommendations can be put into practice.	The "algorithm for selecting swallowing care" inclues "RSST, MWST, FT, cervical auscultation, swallowing observation with an ultrasonic diagnostic device, swallowing observation with an endoscope". , however this algorithm did not state which evaluation method other than endoscopy should be selected, or the order in which those evaluations be performed. This will confuse clinicians when implementing the guideline in the clinical setting.	5
	20. The potential resource implications of applying the recommendations have been considered.		7
	21. The guideline presents monitoring and/ or auditing criteria.	Although it describes the organizational structure after publication, it does not show specific methods for effectiveness evaluation and monitoring.	6.5
Domain 6. Etitoarial Independence	22. The views of the funding body have not influenced the content of the guideline.		6.5
	12. Competing interests of guideline development group members have been recorded and addressed.	I think that they follow the COI guidelines of the academic society, but it is unnatural that there is no COI at all, and it may be necessary to review it of the academic society, or to consider the academic COI as well. At the time of the external evaluation, no information was disclosed regarding the state of conflicts of interest among the members. The disclosed conflicts of interest should include not only economic conflicts of interest but also academic conflicts of interest.	4.5
Overall			6
Others		Since the term "guideline" is often treated as always being observed in non-medical contexts, it is recommended to use the term "clinical practice guideline" to prevent misunderstandings.	
		Comments regarding the description for Japanese writing were deleted from the comment list.	

14. Public comments and their reflection in the clinical practice guideline

Public comments were collected for this clinical practice guideline, during the drafting stage, prior to its publication. The invitation for public comments was disseminated to the members of JANS via e-mails and posts on the website. The draft was posted on the webpage for the members of JANS from February 4 to February 15, 2021, to obtain comments in the form of free responses.

As a result, we received public comments from four JANS members. Of these, the excluding impressions are listed below: the comments are listed not in the order of submission, but in the order of the contents of this clin-

ical practice guideline. The results of the public comments have been reflected in this clinical practice guideline as much as possible. The revised content of each comment was subsequently posted on the JANS website.

About the title

I believe that the title "Guideline for Nursing Care" may be misleading, since I believe that you have created guidelines for assessment and not for specific care content. For example, I think a more appropriate title would be "Guideline for assessment of aspiration and pharyngeal residues during eating and swallowing for nursing care."

[Response] Thank you for this suggestion. You are correct, and we believe that including the term "assessment" would be an appropriate name for the clinical practice guidelines. We have corrected the title as you suggested.

About Part 1

We would like you to consider adding information about teeth and dentures to the physical assessment of the oral cavity. Also, in the clinical setting, physical assessment may be conducted specifically based on the results of items in the questionnaire, so we hope that you will consider this as well. The word "refusal" is used in the literature at the end of p. 42, so it would be appreciated if you would consider adding something like "unable to obtain consent."

[Response] Thank you for your suggestion. We have added some important information, regarding teeth and dentures, that were not previously included in the content of the physical assessment, as you suggested. In addition, as you pointed out, there are actual clinical situations where physical assessment is conducted based on the results of the items in the questionnaire. We have added an explanation in the main body of text for clarification. We have revised the information about the subjects who should be considered for various tests, as you suggested.

15. Sources of funds

Funding for the development of this clinical practice guideline was provided by JANS. No funding was received from any other private company or organization. COIs were collected from the self-reports of the committee members in accordance with the regulations of JANS, and it was confirmed that there were no problems with the COIs. COIs to be disclosed are described in the Clinical Practice Guideline Overview 7. Conflict of interest (COI).

16. Audit criteria

Monitoring will be done by measuring the relationship between the assessments conducted and care choices made and the onset of aspiration pneumonia and the intake of food in the form desired by the recuperator, once every year.

17. Dissemination/implementation of the clinical practice guidelines

There are 10 CQs in this clinical practice guideline, and recommendations for each of them are summarized in a straightforward manner, clearly indicating what is important. Physical assessment, RSST, MWST or FT, and neck auscultation, which are useful in treating patients suspected of having eating and swallowing disorders, do not require special devices and help in the application of these clinical practice guidelines. On the other hand, observation using an ultrasound diagnostic device by a person who has received training in aspiration and pharyngeal residue observation using an ultrasound diagnostic device and who has been certified by the instructor as having a practicable level of skill in aspiration and pharyngeal residue observation using an ultrasound diagnostic device is not widely used. This is because only a limited number of facilities and home-visit nursing agencies have the necessary device and only a limited number of people have mastered the observation technique. Certified nurses, in the field of nursing care for dysphagia, who have received training in the endoscopic observation of aspiration and pharyngeal residue during eating and swallowing and who have been certified by a medical advisor as being able to perform such observations, or nurses with specialized knowledge and experience in eating and swallowing, can perform endoscopic observations of aspiration and pharyngeal residue. Endoscopy also has similar disadvantages; the number of facilities and offices that have the applicable device and the number of people who have mastered the observation techniques is limited. The training of people who can acquire observation techniques is an important issue to be considered for the future.

This clinical practice guideline will be published in Japanese and English, and the full text will be available on the websites of the JANS and Minds. The Japanese version will also be published as a book. This clinical practice guideline includes a summary for the general public. In addition, a digest version and a systematic review will be published in the Japan Journal of Nursing Science, the official English-language journal of the JANS. Furthermore, we aim to promote the use of this clinical practice guideline by holding lectures at academic meetings.

18. Post-publication efforts

1) Organizational structure after release

After the release of the clinical practice guidelines, the Supervisory Committee and Clinical Practice Guideline Development Group will continue their activities to promote the adoption of these clinical practice guidelines, evaluate their effectiveness, and check for the emergence of new studies that may affect the recommendations of the guidelines.

2) Effectiveness assessment and monitoring

To evaluate the effectiveness of this clinical practice guideline, we plan to assess whether patient outcomes, related to aspiration and pharyngeal residue during eating and swallowing, such as the incidence of aspiration pneumonia, improve with the implementation of this guideline. These will be measured once every year from the time of introduction of the clinical practice guidelines.

3) Revisions

This clinical practice guideline will need to be revised periodically to reflect new evidence and changes in the situation regarding medical services. The guideline will approximately be revised every three to four years. We will consider making revisions as needed if new physical assessment techniques, screening tests, or definitive diagnostic methods are proposed, and if assessment criteria change before that.

Part 1.

Basic characteristics of aspiration and pharyngeal residue during eating and swallowing

1. Clinical characteristics

Aspiration during eating and swallowing refers to the flow of food or liquid below the vocal folds into the trachea. Pharyngeal residue during eating and swallowing refers to food or liquid remaining in the pharynx. Since aspiration and pharyngeal residue are part of dysphagia, a basic understanding of dysphagia is essential. The following will provide an overview of the basic features of aspiration and pharyngeal residue during eating and swallowing.

1) What is dysphagia?

Eating and swallowing refer to the recognition of food, taking it into the oral cavity (catching), forming a food bolus by chewing, sending the food bolus from the oral cavity to the pharynx, sending it from the pharynx to the esophagus by swallowing reflex, and sending it from the esophagus to the stomach by peristalsis. The term "dysphagia" refers to a condition in which one of the processes of eating and swallowing is impaired. In dysphagia, examination findings, as well as problems in daily life, such as pneumonia, choking, dehydration, low nutrition, and loss of enjoyment of eating are considered important. Aspiration and pharyngeal residue during eating and swallowing are part of dysphagia.

The assessment of aspiration and pharyngeal residue during eating and swallowing is very important to prevent aspiration pneumonia. Pneumonia occurring in patients with proven (or strongly suspected) dysphagia and aspiration is called aspiration pneumonia.[1)] Aspiration pneumonia (**Table 1**) is caused by aspiration of the food itself or bacteria attached to food, as well as aspiration of bacteria from the oropharynx, in combination with poor nutritional status and immunity. The aspiration of bacteria attached to food or oropharyngeal secretions is the main mechanism by which bacteria enter the lungs.[2)] Furthermore, the entry of protein-containing food into the lungs causes lung inflammation.

Table 1: Overview of aspiration pneumonia

Main mechanism	Aspiration of the food itself or bacteria attached to food
Pathophysiological process	Acute inflammatory response of the lung to bacteria or bacterial products
Bacteriological findings	Gram-positive cocci, Gram-negative rods, and anaerobes
Major risk factor	Dysphagia
Susceptible age groups	Usually, older adults
Typical patient clinical features	Clinical features of pneumonia in a person with dysphagia and cellular infiltration of the lung inferred from localized, ill-defined shadows on chest x-ray in the bronchopulmonary area
Characteristics of the clinical condition	Tachycardia, cough, signs of pneumonia

2) Organs, structures, and functions involved in eating and swallowing

Organs associated with eating and swallowing include the lips, tongue, cheeks, teeth, mandible, salivary glands, hard palate, soft palate, uvula, epiglottis valley, epiglottis, laryngeal vestibule, pyriform fossa, larynx,

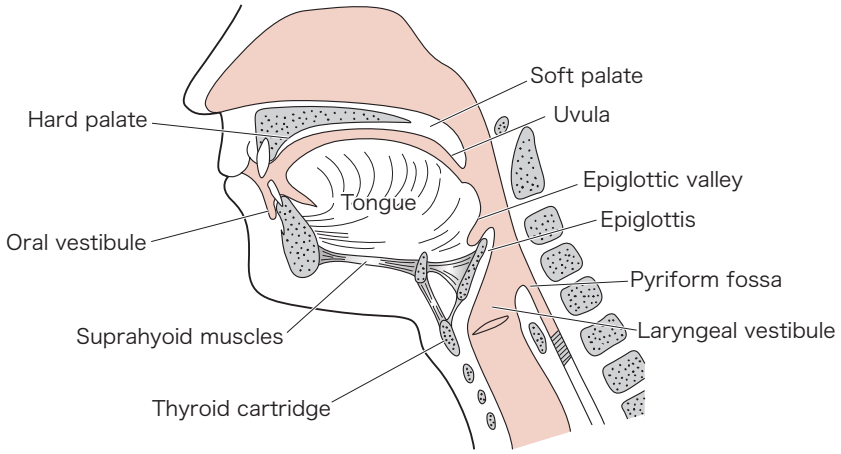

Figure 1: Organs and structures involved in eating and swallowing

Kamakura, Y. (ed.) Dysphagia Nursing: From Physical Assessment to Swallowing Training Igaku Shoin (2000).[3] Revised.

hyoid bone, and esophagus (**Figure 1**).

The sequence of eating and swallowing movements is as follows: after catching food, the food is carried by the tongue to the molars, then the food is chewed, mixed with saliva, and the chewed food is sequentially sent from the oral cavity to the pharynx and esophagus. The process of transporting food to the oral cavity, pharynx, and esophagus is described in more detail. First, when the food approaches the mouth and the mouth voluntarily opens, the tongue protrudes to the interincisal space. Next, when the food touches the tongue apex, the tongue retracts back into the mouth with the food. Then, as soon as the food is taken into the mouth, the mouth closes, and the entire tongue moves backward to move the food on the tongue to the molars (Stage I transport). When the food reaches the molars, the tongue, cheeks, and back teeth are used to crush the food and mix it with saliva to form a food bolus. During the process of chewing, the gullet is closed by the back of the tongue and soft palate to prevent the food bolus from moving into the pharynx. As the food is chewed and begins to form small soft fragments suitable for swallowing, the food bolus is squeezed by the tongue and palate through the narrow part of the mouth into the pharynx (Stage II transport). Mastication and delivery occur parallelly, and during mastication, the food bolus is sequentially delivered to the mesopharynx by stage II transport. This stays in the pharynx for 5 to 10 seconds. Next, the soft palate is elevated, and pharyngeal contraction is initiated by the pharyngeal contractor muscles, resulting in the closure of the space between the nasopharynx and the middle pharynx (nasopharyngeal cavity closure*). At about the same time, with the backward movement of the root of the tongue, the suprahyoid muscle group contracts, and the hyoid bone and larynx are pulled upward and forward, causing the epiglottis to invert and close the laryngeal opening (laryngeal closure). In this way, the pharyngeal cavity becomes a closed space in which the swallowing pressure is created by the backward movement of the tongue and peristaltic-like contractions (pharyngeal contractions), from the top to the bottom, by the upper, middle, and lower pharyngeal contractor muscles. In addition, the larynx is pulled upward in the anterior direction, which facilitates the widening of the esophageal entrance and pushes the food bolus downward. At the same time, the upper esophageal sphincter relaxes, the esophageal entrance opens, and the food bolus moves into the esophagus.

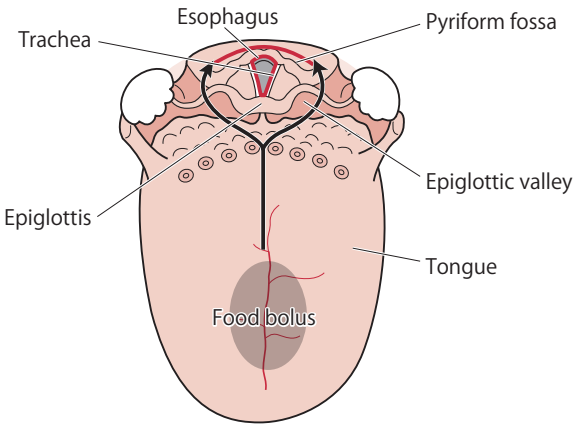

Figure 2: Movement of the food bolus

Baba, M. and Kamakura, Y. Eating and swallowing disorders from the brain to the body. Gakken Medical Shujunsha. Tokyo, 2013.[4] Revised.

*Nasopharyngeal cavity closure: The nasopharyngeal cavity refers to the veropharynx. Although there is no anatomical luminal structure called the "nasopharynx," the term nasopharyngeal cavity, which is widely used in general, has been used here.

The oral cavity and pharynx, which control swallowing, are also organs that control breathing and speech. In particular, the pharynx is the site where the food, respiratory, and vocalization pathways intersect. Therefore, when swallowing, the laryngeal opening is closed by the epiglottis. At the same time, the pseudopharyngeal and vocal cords are closed (vocal cord closure), blocking the passage of the food bolus and the airway to prevent aspiration (airway protection). In addition, breathing stops at this time (swallowing apnea).

The food bolus is pushed in the direction of the pharynx by voluntary movement of the tongue, which then splits left and right near the epiglottic trough, and flows through the left and right pyriform fossa into the esophagus (**Figure 2**).

Pharyngeal swallowing is an involuntary movement in which complex movements happen in a short period with high reproducibility, and is controlled by the central pattern generator (CPG) in the brainstem. The swallowing CPG consists of a solitary bundle nucleus in the medulla oblongata surrounding the reticular formation and swallowing-related neurons in each motor nucleus. When a food bolus passes through the anterior palatine arch, which forms the glottis—the entrance to the pharynx, sensory input is provided via afferent nerves, such as the trigeminal, glossopharyngeal, and superior laryngeal nerves. Stimuli that reach the fox bundle nucleus in the medulla oblongata reflexively trigger the swallowing CPGs in the reticular formation of the medulla oblongata. This, in turn, triggers the movement of swallowing-related muscle groups in the pharynx, larynx, and tongue through centrifugal nerves, such as the trigeminal nerve, vagus nerve, and hypoglossal nerve via the pseudonucleus and surrounding motor nuclei. From the onset of the swallowing CPG to the contraction of the swallowing-related muscles, the output is always in the same order and same pattern. In addition, the cerebral cortex and limbic system control the activity of the swallowing reflex center. The cerebral cortex involved in swallowing includes the primary motor cortex and sensory areas from the mouth to the pharynx and larynx.

The process by which food and drinks are delivered to the pharynx, while chewing food and drinking liquids,

Table 2: Models of eating and swallowing

Four-phase model: Physiological model (swallowing of liquid on command)	Process model: Physiological model (chewing and swallowing of foods)	Five-phase model: Clinical model
		Antecedent phase: Food is recognized by sight, smell, and touch, and then brought to the mouth using eating utensils.
Oral preparation phase: Food is taken into the mouth and prepared for swallowing.	Stage I transport: Predigested food is carried by the tongue to the molars. Processing: Chewed food is mixed with saliva to form a food bolus.	Preparation phase: Food is taken into the mouth and chewed to form a food bolus.
Oral feeding phase: Food boluses are pushed into the pharynx with the tongue.	Stage II transport: Chewed food is sequentially sent to the mesopharynx and laryngeal valley for accumulation. During this time, the processing is still taking place.	Oral phase: Food boluses are delivered to the pharynx by the tongue.
Pharyngeal phase: Food boluses that reach the pharynx are transferred into the esophagus by reflex.		
Esophageal phase: Food bolus is transferred to the stomach by peristalsis.		

respectively, before swallowing is different. Command swallowing of liquids is a process in which water is directed to the pharynx by tongue movement and into the esophagus by the swallowing reflex; this is called the four-phase model. In the four-phase model, oral preparation, oral feeding, the pharyngeal phase, and esophageal phase proceeded without overlap. On the other hand, chewing and swallowing of food involves chewing to form a food bolus before the pharyngeal phase begins (processing); this is called the process model. Besides, the five-phase model includes a preceding period where people recognize food and take it into the oral cavity. **Table 2** summarizes these models.

3) Disorders at each stage of eating and swallowing

Clinically, dysphagia is classified based on the five-phase model into the preceding, preparation, oral, pharyngeal, and esophageal phases. Disorders of the preceding period include food recognition-related disorders, such as consciousness, dementia, emotional disturbance, intellectual disability, and higher brain dysfunction (e.g., hemispheric and ideational apraxia). Disorders in the preparation phase include inadequate food bolus formation due to opening and closing disorders, lip closure disorders, masticatory disorders, and oral sensory disorders. Oral phase disorders include impaired feeding into the pharynx due to impaired tongue movement. Pharyngeal phase disorders include delayed elicitation of the swallowing reflex, nasopharyngeal insufficiency, glossopharyngeal insufficiency, laryngeal insufficiency, laryngeal elevation insufficiency, esophageal inlet opening insufficiency, and decreased pharyngeal clearance (e.g., residual food bolus in the epiglottic valley, laryngeal vestibule, and pyriform fossa). Disorders of the esophageal phase include decreased esophageal peristalsis and gastroesophageal reflux due to inadequate esophageal sphincter closure.

The most problematic disorder of the pharyngeal phase is aspiration, in which the food bolus passes beyond the glottis and enters the trachea. Aspiration is a consequence of oral and pharyngeal disorders and can be classified into ascending, descending, mixed, and dysphagia aspirations based on the relationship between laryngeal elevation and aspiration. Logemann (1998) classified aspiration into pre-swallowing, mid-swallowing, and post-

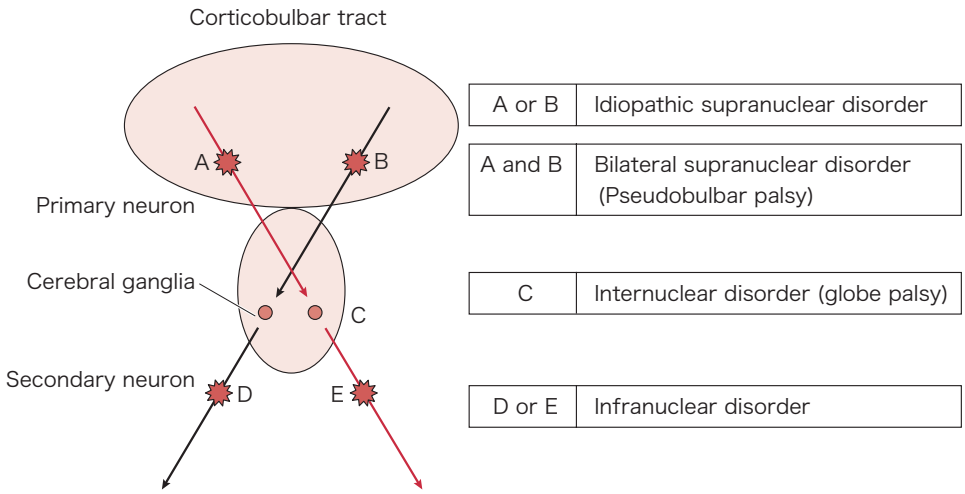

Figure 3: Motorneurons involved in eating and swallowing

Baba, M. and Kamakura, Y. Eating and swallowing disorders from the brain to the body. Gakken Medical Shujunsha. Tokyo, 2013.[4] Revised.

swallowing aspiration.[5] Pre-swallowing aspiration is aspiration that occurs before the swallowing reflex is triggered, and is due to inadequate closure of the tongue and palate, impaired tongue movement, etc. Aspiration during swallowing is aspiration that occurs during swallowing and is caused by delayed elicitation of the swallowing reflex, insufficient laryngeal elevation, and inadequate laryngeal closure during the pharyngeal phase. Post-swallowing aspiration occurs after the completion of the swallowing motion and is due to decreased pharyngeal clearance and post-swallowing breathing pattern starting with inhalation after the swallowing motion.

4) The main causes of dysphagia

The main causes include aging, diseases, and oral medications. Of these, aging and stroke have the greatest impact; therefore, we have discussed these two in this section. Aging causes a decrease in the number of taste buds, and the threshold for tastes, such as saltiness and bitterness, increases, making the swallowing reflex less likely to be elicited. An increase in olfactory thresholds and a decrease in the ability to discriminate between odors above the threshold also make elicitation of the swallowing reflex less likely. The decrease in the number of remaining teeth and bite force results in a decrease in masticatory function and difficulty in forming food boluses. In addition, with aging, the strength of swallowing-related muscles decreases, fatigue increases, and swallowing pressure decreases. This would result in repetitive swallowing because the food bolus would remain in the epiglottic valley or pyriform fossa after swallowing. When the position of the larynx descends due to aging, laryngeal insufficiency occurs, making aspiration more likely. Decreased swallowing and coughing reflexes can also lead to aspiration without swallowing or subclinical aspiration. Due to these physiological and age-related physical changes, the older adults are at an increased risk of aspiration and pharyngeal residue.

To understand the pathogenesis of stroke-induced dysphagia, it is necessary to understand the relationship between the nerves associated with eating and swallowing (**Figure 3**).

Disability due to stroke is divided into three categories (**Figure 3**). The first is supranuclear disorder, where the primary neurons (A) or (B) are damaged. This disorder occurs above the nerve nuclei of the brain. Besides, it is referred to as unilateral supranuclear disorder with the term "unilateral" added to it, when the contralateral

lower motor neurons in the nuclei of the brain involved in swallowing are damaged. However, since the nucleus accumbens (glossopharyngeal and vagus nerves) are innervated by both sides of the cerebral cortex (bilateral innervation), the swallowing reflex itself is not impaired by either (A) or (B). In addition, the upper facial nerve nucleus and part of the hypoglossal nerve nucleus are bilaterally innervated.[4)]

The second is bilateral supranuclear disorder, where both (A) and (B) are impaired. The glossopharyngeal and vagus nerves of the inferior motor neurons are bilaterally affected, resulting in pseudobulbar palsy and severe dysphagia, although the swallowing reflex remains.

The third is Case (C), in which the cranial nerve nucleus is damaged. When cerebral nerve nuclei are damaged unilaterally, subnuclear lower motor neurons are damaged, resulting in ball palsy. In this case, the swallowing reflex is diminished or absent, resulting in severe dysphagia.

The recovery phase of stroke and dysphagia depends on the type of disability. In bilateral supranuclear and nuclear disorders, dysphagia that appears in the acute phase often continues to the recovery phase due to pseudoparalysis or ball palsy. In contrast, in the case of unilateral supranuclear disorder, the swallowing function improves during the recovery period. In addition, because it is unilateral, the non-paralyzed side compensates for the impaired side, and the dysphagia resolves. However, as swallowing function declines with age, dysphagia is likely to reappear; therefore, careful monitoring of the patient's progress is important. In addition, if the patient has recurrent strokes and unilateral supranuclear damage on the non-paralyzed side, the damage becomes bilateral, and even during recovery, the pseudobulbar palsy remains dysphagic.

2. Epidemiological characteristics

The prevalence of dysphagia increases with age. The prevalence of dysphagia in community-dwelling older adults has been reported to range from 27 to 34%.[6, 7)] The prevalence of dysphagia varies among settings. The prevalence of dysphagia in acute geriatric units has been reported to be around 45%.[8, 9)] In nursing homes, the prevalence has been reported to be 53–70%.[10, 11)]

In Japan, pneumonia replaced unintentional accidents as the fourth leading cause of death in 1975, and has been on an upward trend, rising and falling, and replaced cerebrovascular disease as the third leading cause of death in 2011; it accounts for 9.4% of the total deaths in 2015. The all-cause mortality rate for pneumonia is 96.4 (per 100,000 population), but the rate is higher for those aged 80 years or older (972.7).[12)] Of the estimated 1,880,000 cases of pneumonia that occur in Japan, 69.4% cases are among people aged 65 years and older, and another 630,000 are cases of aspiration pneumonia.[13)] Since 2017, aspiration pneumonia has been recorded separately from pneumonia, and pneumonia has become the fifth leading cause of death, and aspiration pneumonia the seventh.[12)]

Dysphagia is a risk factor for pneumonia among the older adults. Low rates of swallowing function testing are one of the problems preventing pneumonia among these populations. Twenty-two hospitals in Japan allowed the survey of patients admitted for the treatment of pneumonia. The findings showed that 75% of the 589 patients admitted to the hospital with pneumonia were aged 70 years or older, and 80.1% of those aged 70 years or older were diagnosed with aspiration pneumonia. WST was performed in 58.4% of patients admitted to the hospital with pneumonia, and RSST and simple swallowing provocation tests were performed in approximately

20% of the patients. Swallowing angiography was performed in only 6.2% of patients.[14)]

Cerebrovascular disease is a risk factor for dysphagia. In addition to cerebrovascular disease, traumatic brain injury, neurological disease, myositis, muscle disease, dementia, and tumors of the oral and pharyngeal regions are among the causes of dysphagia that contribute to aspiration pneumonia. In the 2012 survey (N = 27,659), cerebral infarction and cerebral hemorrhage accounted for more than half of all cases.[15)] Other cases had subarachnoid hemorrhage (5.1%), Parkinson's disease (4.9%), Alzheimer's disease (2.6%), head injury and cerebral palsy (2.5% each), spinocerebellar degeneration (2.0%), amyotrophic lateral sclerosis (1.1%), and chronic subdural hematoma and disuse syndrome (1.0% each). Some diseases, such as neurological disorders, myositis, and oral and pharyngeal tumors, occur majorly in middle-aged patients; therefore, preventive measures against aspiration pneumonia are necessary not only for the older adults but also for all age groups with dysphagia. The aim of dysphagia rehabilitation for patients with intermediate disabilities who have experienced oral intake and the older adults is to restore function, whereas that for pediatric patients is to acquire eating and swallowing functions. In addition, pediatric patients differ from adults in that they require rehabilitation tailored to their level of development, taking into account their growth and development. In this guideline, we will focus on swallowing rehabilitation in adults. For this guideline, adults are defined as those aged 18 years or older.

3. International trends in the management of oropharyngeal dysphagia

1) Roles of professionals

In the U.S., SLPs play an important role in the management of oropharyngeal dysphagia. They often conduct instrumental assessments, using videoendoscopy (VE) and videofluoroscopy (VF). The American Speech-Language-Hearing Association, which is a national professional, scientific, and credentialing association with 211,000 members, officially stated that fiberoptic endoscopy is an imaging procedure that may be utilized by SLPs to evaluate the swallowing function. SLPs with expertise in dysphagia and specialized training in fiberoptic endoscopy are professionals qualified to use this procedure independently to assess the swallowing function and related functions of other structures. Although SLPs play an important role in the management of oropharyngeal dysphagia, multidisciplinary teams are involved in its complementary management. Nurses provide physical assessments or bedside screening tests. Occupational therapists improve feeding behavior and eating during daily life activities. Dieticians or nutritionists provide recommendations to maintain appropriate caloric and nutritional intake when dietary texture modifications or non-oral feeding are necessary.

In Europe, multidisciplinary teams are involved in the management of oropharyngeal dysphagia, including physicians, nurses, speech-language therapists, physical therapists, and dieticians. However, instrumental assessments, using VE and VF, are provided by limited physicians. Recently, the demand for the instrumental assessment of dysphagia has increased due to the increase in the number of patients with eating and swallowing disorders in the aging society. The European Society for Swallowing Disorders has started to offer and organize an interdisciplinary pan-European training curriculum for fiberoptic endoscopic swallowing of swallowing (FEES) for neurogenic and geriatric dysphagia since 2017. This program is based on the German FEES curriculum, which has been in use since 2014. This training curriculum is open to all clinicians with an interest in this topic. It also offers health care professionals the opportunity to acquire qualifications in the area of instrumental dys-

Table 3: Medical fees for dysphagia rehabilitation

Item	Points
Reimbursements related to the field of dysphagia rehabilitation	
Functional eating therapy (per day)	1. For more than 30 minutes: 185 points (Calculated per day for patients within 3 months from the start of treatment, and 4 times per month thereafter) 2. For less than 30 minutes: 130 points (Calculated per day for stroke patients with dysphagia, when performed for 15 minutes or more, within 14 days of onset.)
Swallowing Support fee	200 points (Additional support fee for eating and swallowing is calculated when necessary guidance and management is provided jointly by multiple professionals to patients whose eating and swallowing functions are expected to recover through the actions of a team consisting of multiple professionals with expertise in supporting the recovery of eating and swallowing functions.)
Nutrition Support Team fee (Once a week)	200 points
Fee for the evaluation of swallowing function during gastrostomy	2500 points
Endoscopic swallowing function examination	720 points
Fluoroscopic diagnosis	110 points
Contrast injection technique: Swallowing contrast	240 points
Ultrasonography: A mode	150 points
Ultrasonography, tomography, others (head and neck, etc.)	350 points
Fee for oral health and nutrition in facility-based services	
Fee for maintenance of oral ingestion (I)	28 units/day
Fee for maintenance of oral ingestion (II)	5 units/day
Fee for transition from tube feeding to oral ingestion	28 units/day

1 point equals 10 Japanese yen.

phagia assessment and expand their range of activities.

In Japan, multidisciplinary teams are involved in the management of oropharyngeal dysphagia, including physicians, dentists, nurses, speech-language-hearing therapists, physical therapists, occupational therapists, dieticians, and dental hygienists. Instrumental assessments, using VE and VF, are usually provided by physicians in otolaryngology, rehabilitation medicine, or dentists. Nurses and speech-language-hearing therapists often provide physical assessments or screening tests to plan the management of oropharyngeal dysphagia. The Japanese Nursing Association has managed the Training School for Dysphagia Nursing since 2007. They offer paid educational lectures and clinical training for one year and a certification program as a certified dysphagia nurse through evaluation tests. The educational program included training on VE-based assessment.

2) Medical and nursing care fees related to the content of the guideline

The U.S. has a private insurance system in which each citizen is responsible for purchasing and maintaining their healthcare insurance coverage. Most people in the U.S. secure insurance through their employers. The costs of traditional diagnostic and therapeutic interventions for dysphagia are covered by payers. The duration of treatment differs between payers. Premier private insurance covers all treatment sessions needed as long as they are deemed medically necessary.

In Japan, universal coverage started in 1961, and virtually all Japanese people are covered by social health insurance. Patients usually pay 30% of medical costs, but older adults aged 75 or older pay only 10%. Older adults aged between 70 and 74 pay 20%. In addition, medical subsidies are provided for people with financial hardships, people with disabilities, infants, and children. **Table 3** summarizes the reimbursements related to the

field of dysphagia rehabilitation. One point is equal to ten Japanese yen.

4. Assessment of aspiration and pharyngeal residue during eating and swallowing and nursing care

1) Aim and methods of assessment and nursing care

The goal of assessing aspiration and pharyngeal residue during eating and swallowing, and nursing care is to regain the activity and joy of eating. Therefore, we aim to help those who cannot eat at all to eat at least a little, those who can only eat a little to eat more, and those who have trouble with choking or repeated aspiration pneumonia to eat safely. The first step in dysphagia rehabilitation is collecting information, and then, the second step is planning and implementing a training program. Information collection includes understanding the pathogenesis of the primary disease, observation of actual meals, screening tests to identify people who are at risk for dysphagia disorders, and dynamic observation of relevant organs using images from endoscopy and contrast studies. Assessment of aspiration and pharyngeal residue and planning of a training program are based on this information. Training is then conducted while ensuring a safe training environment and observing the general condition of the patient. Varied knowledge and skills are required to implement these processes. In addition, dysphagia rehabilitation is performed by a team of physicians, dentists, nurses, speech-language-hearing therapists, physical therapists, occupational therapists, dental hygienists, pharmacists, radiologists, dietitians, cooks, care staff, medical social workers, and family members.

2) Algorithm for nursing care choices based on the assessment

The algorithm in **Figure 4** shows the flow of different steps, including physical assessment, screening, scrutiny and comprehensive evaluation, goal setting, and care-type selection for implementation, to achieve safe food intake. **Figure 4** was developed by an AMED (Japan Agency for Medical Research Development) study "Construction of a Multi-Professional Collaboration System to Support Eating, Swallowing, and Defecation of Patients Receiving Care at Home or in Nursing Homes by Introducing Advanced Nursing Techniques." In this study, we attempted to standardize care for "care selection based on observation using an ultrasound diagnostic device" and "care selection based on observation using a swallowing endoscope," as shown in **Figure 4**. The algorithm used to standardize care is as follows:

The algorithm targets individuals suspected of having dysphagia. The CQs in this guideline follow this algorithm. Nurses should perform a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) to determine symptoms and screen patients for aspiration and residual pharyngeal swallowing. In the SR of this guideline, physical assessment includes obtaining information from interviewing the patient and family and physically examining the brain and nervous system parts involved in eating and swallowing (mainly, the olfactory, optic, trigeminal, facial, glossopharyngeal, vagus, accessory, and hypoglossal nerves), the respiratory system, nutritional status, facial appearance, speech, lips, temporomandibular joint, oral cavity, tongue, soft palate, anterior palatal arch, oral sensation, larynx, trachea, lungs, and general condition based on interviews, visual examination, palpation, auscultation, and percussion. In addition, the Toronto Bedside Swallowing Screening Test (TOR-BSST)[16, 17] and the Mann Assessment of Swallowing

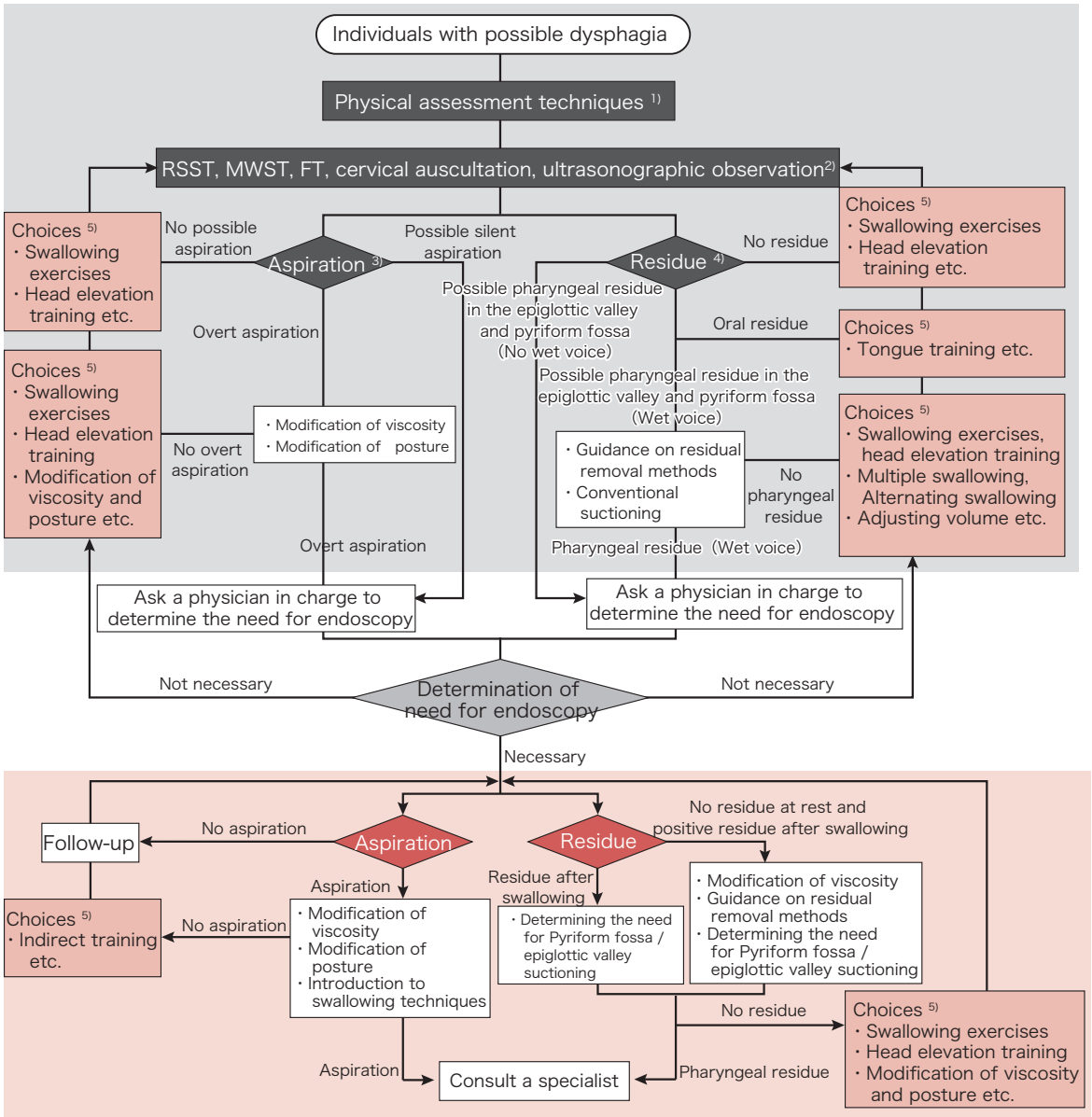

Figure 4: The algorithm for making nursing care choices for the management of oropharyngeal dysphagia

1) : It refers to a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion).The Toronto Bedside Swallowing Screening Test (TOR-BSST) and The Mann Assessment of Swallowing Ability (MASA) are generally regarded as screening tests, but in this guideline, they are regarded as physical assessments.

2) : RSST (Repeated Saliva Swallowing Test), MWST (Modified Water Swallowing Test), FT (Food Test), cervical auscultation, and observation with ultrasound device are positioned as screening tests in this guideline.

3) : Assess by RSST, MWST, FT, cervical auscultation, or ultrasonographic observation.

4) : Assess by MWST, FT, cervical auscultation, or ultrasonographic observation. Ft only assess oral residue

5) : Oral care and nutrition management are commonly included in all care choices.

Ability (MASA)[18] are generally regarded as screening tests, but were included for physical assessment in the systematic reviews used for the development of this clinical practice guideline. On the other hand, the screening tests included RSST, MWST, FT, cervical auscultation, and observation with an ultrasound diagnostic device.

Table 4: Objective information

Observation point	Observation item
Face appearance	Left-right difference in forehead wrinkles, nasolabial folds, and mouth corners, and eyelid closure
Conversation	Voice volume, voice quality, abnormality of articulation (pa, ta, ka, ga)
Lips	Insufficiency of closure, lateral pull (E), and protrusion (U)
Temporomandibular joint	Mouth-opening status
Oral cavity	Contamination status, halitosis, number of remaining teeth, and condition and use of dentures
Tongue	Unevenness, lichen on tongue, dryness, the difference between the right and left sides at rest, deterioration of movement
Soft palate	Curtain symptoms, deterioration of sensation
Anterior palatine arch	Deterioration of swallowing reflex
Intra-oral sensation	Decreased sensation of the tongue, lips, buccal mucosa, hard palate, and floor of the mouth
Larynx	Insufficient laryngeal movements (saliva swallow commands or swallow commands using less than 5 ml of water)
Neck	Abnormal cervical breath sounds during swallowing
General condition	Abnormal blood pressure, pulse, respiratory rate, body temperature, weight, chest breath sounds

The screening tests selected differed between those used for the observation of aspiration and those for the observation of pharyngeal residues. Aspiration is assessed by RSST, MWST, FT, cervical auscultation, or an ultrasound diagnostic device. The pharyngeal residue is assessed by MWST, cervical auscultation, or an ultrasound diagnostic device, and oral residues are assessed by FT. The recommended order of selection of the screening tests is RSST first, MWST and FT second, and cervical auscultation or observation with an ultrasound diagnostic device third; however, these should be selected according to the subject's intentions and environmental conditions in which these tests are performed. If an abnormality is suspected, appropriate care is selected, but if the problem persists, it is necessary to ask the attending physician to determine the need for endoscopy. Observation by an ultrasound diagnostic device should be performed by nurses who have been recognized by their instructors as being at a level where they can practice aspiration and pharyngeal residue observation techniques using an ultrasound diagnostic device. If physicians determine that endoscopy is necessary, certified nurses in dysphagia nursing or nurses and others, who have specialized knowledge and experience in eating and swallowing, who have received education in endoscopic aspiration and pharyngeal residue observation, and have been recognized by their supervising physicians as being at a level where they can practice endoscopic aspiration and pharyngeal residue observation, can observe aspiration using an endoscope. The nurses insert the endoscope through the nasal cavity into the soft palate and observe the pharyngeal cavity. If aspiration or pharyngeal residue is observed, the patient should be managed, but if the problem persists, the patient should be referred to a specialist, such as a rehabilitation physician, for further examination.

3) Assessment methods

(1) Physical assessment

The assessment is based on subjective information obtained from interviews with patients, families, and caregivers, and objective information obtained from visual examination, palpation, auscultation, and percussion. Objective information includes observations of facial appearance, speech, the lips, temporomandibular joint, oral cavity, tongue, soft palate, anterior palatal arch, oral sensation, larynx, and the general condition (**Table 4**).[3)]

Table 5: Duration, limitations, the burden on caregivers, and reliability of screening tests

	Time (including preparation, implementation, evaluation, and cleanup)	Limitations on the implementation for those with cognitive decline	Burden on the caregivers	Intra-rater reliability	Inter-rater reliability
RSST (Fukada, 2006) [19]	30 seconds–1 minute	Existence (at the present moment)	Elementary And Middle	r = 0.68	r = 0.95
MWST (Fukada, 2006) [19]	About 2 to 3 minutes	Not much - Yes	Elementary And Middle	Kappa coefficient: 0.88	Kappa coefficient: 0.82
FT (Fukada, 2006) [19]	About 2 to 3 minutes	Not much - Yes	Elementary And Middle	Kappa coefficient: 0.87	Kappa coefficient: 0.84
TOR-BSST (Martino, 2006; 2009) [16, 17]	Less than 10 minutes	Not much - Yes	Elementary And Middle	Kappa: 0.90	ICC = 0.92 (95% CI: 0.85–0.96)
Cervical auscultation*. (Lagarde, 2016) [20]	2–3 minutes on each side	None	Small	Kappa coefficient: 0.35-0.55	AC1: 0.46 ICC: 0.68–0.74 Kappa coefficient: 0.17–0.28
Ultrasound diagnostic equipment	About 10 minutes	None - not really	Small	No data	No data
Endoscope** (Pisegna, 2018)[21]	About 5 minutes	Not much, but it can be difficult to get consent.	Small	Kappa coefficient: 0.78	ICC: 0.86

AC1: agreement coefficient 1
ICC: intraclass correlation coefficients
CI: confidence interval
*The results obtained by the speech-language pathologist are listed for reference. There are no reports on the results of tests conducted by nurses.
**The results of tests performed by the doctor are listed for reference. There are no reports on the results of tests conducted by nurses.

When conducting physical assessments, especially when observing the respiratory status, it is advisable to properly clean and moisturize the oral cavity, perform positional drainage, and promote pharyngeal clearance before conducting the assessment.

(2) Screening test

Screening tests include the RSST, MWST, FT, cervical auscultation, and cough test, all of which are appropriate for the patient's condition. **Table 5** shows the time required, limitations, and patient burden for the major screening tests. In clinical practice, screening tests are combined to comprehensively determine the swallowing function.

Repetitive Saliva Swallowing Test (RSST): This test is performed in a sitting position with the neck slightly bent forward. Place the second finger on the hyoid bone and the third finger on the laryngeal ridge (thyroid cartilage) and instruct the patient to swallow saliva continuously. Count the number of times the laryngeal ridge overcomes the third finger and moves upward and forward with the swallowing motion for 30 s. If the number of swallows is less than three, the patient is considered to be at risk for dysphagia.

Modified Water Swallowing Test (MWST): The evaluation method is shown in **Table 6**. Pour 3 ml of cold water into the floor of the mouth with a disposable syringe and instruct the patient to swallow. If the patient is unable to swallow or if subclinical aspiration is suspected, the procedure is terminated immediately. If the patient swallows and breathes properly, check if there is wet hoarseness in "a-." If there is choking or wet hoarseness, terminate the test immediately and rate the patient's condition at 3 points. If there is no choking or wet hoarseness, signal "swallow" and instruct the patient to swallow twice; if the patient can swallow twice within 30 seconds, rate the patient at 5 points; if not, rate the patient at 4 points. To ascertain the voice quality before

Table 6: Evaluation method of MWST

Procedure	
1	Pour 3 mL of cold water into the bottom of the mouth and instruct swallowing.
2	Swallowing error, have the patient do two repetitive swallows.
3	If the evaluation criterion is 4 points or more, repeat up to two trials.
4	The lowest score is used as the grade.
Evaluation	
1 point	No swallowing, choking, and/or respiratory distress
2 points	Swallowing present, respiratory urgency (suspicion of subclinical aspiration)
3 points	Swallowing and good breathing, and swallowing and/or hoarseness
4 points	Swallowing present, breathing good, no swallowing
5 points	In addition to 4, repetitive swallowing can be done twice within 30 seconds

Table 7: Evaluation method of FT

Procedure	
1	Place approximately 4 g of swallowing jelly on the anterior dorsal surface of the tongue and instruct the patient to swallow.
2	Swallowing error, have the patient do two repetitive swallows.
3	If the evaluation criterion is 4 points or more, repeat up to two trials.
4	The lowest score is used as the grade.
Evaluation	
1 point	No swallowing, choking, and/or respiratory distress
2 points	Swallowing present, respiratory urgency (suspicion of subclinical aspiration)
3 points	Swallowing present and good respiration, swallowing and/or wet hoarseness, moderate oral residue
4 points	Swallowing and good breathing, no swallowing, almost no oral residue
5 points	In addition to 4, repetitive swallowing can be done twice within 30 seconds

swallowing the cold water, the patient vocalized before the procedure. If the evaluation score was 4 or more, two trials were conducted; the worst of the two values was considered the grade. It is important to maintain the oral environment, especially in areas under the control of the glossopharyngeal and vagus nerves before conducting the test. In addition to MWST, there are various other methods that vary the amount of water to be consumed. In general, the water water swallowing test increases the amount of water in stages and assesses whether the patient can swallow without aspiration. In addition, tongue movement is also observed to assess the tongue movement leading to chewing, for example, whether the tongue comes out when water is placed on the upper lip.

The Toronto Bedside Swallowing Screening Test (TOR-BSST): The test was developed in 2009 by Martino et al. in Canada. This is a dysphagia screening test for patients with stroke. A physical assessment (vocalization, tongue movement, and pharyngeal sensation) was performed first, followed by drinking 10 sips of 5 ml of water, a sip from a glass, and observing the voice changes and swallowing. The examiner needs to undergo the prescribed training.

Food Test (FT): The evaluation method is shown in **Table 7**. Using a teaspoon, place approximately 4 g of

jelly on the anterior dorsal surface of the tongue and instruct the patient to swallow. The method of conducting and judging the test is the same as the MWST, but the difference is that the oral residue after swallowing is the subject of evaluation. A score of 3 is assigned if there is a moderate amount of oral residue after swallowing, and a score of 4 or higher is assigned if the patient swallows without swallowing and there was no oral residue. If the evaluation score was 4 or more, two trials were conducted, and the worst of the two values was recorded. It is important to maintain the oral environment, especially in areas innervated by the glossopharyngeal and vagus nerves before conducting the FT.

Cervical auscultation: The swallowing sound produced in the pharynx when swallowing food boluses and the respiratory sound before and after swallowing are auscultated from the neck, and the nature and length of the swallowing sound and the nature and timing of the respiratory sounds were listened to in order to determine if the patient had dysphagia in the pharyngeal phase. If there were sounds of food being poured into the pharynx, wheezing, coughing, or wet hoarseness before the swallowing reflex, an abnormality was suspected.

Cough Test: This test evaluates the presence and frequency of the cough reflex by inhalation of an atomized cough-inducing substance (1% citric acid saline solution). The cough test screens for responsiveness of the larynx and trachea to stimulation, that is, the risk of silent aspiration. It is not used for the evaluation of aspiration and pharyngeal residue during eating and swallowing, which is the subject of the current guidelines.

In addition to these screening tests, questionnaires may be used to screen and check for symptoms of dysphagia efficiently. Screening questionnaires included the Seirei questionnaire of swallowing, the modified dysphagia risk assessment scale, and the eating assessment tool-10 (EAT-10). Questionnaires are often administered after reviewing the chief complaints and medical history. A more detailed physical assessment may also be conducted based on the information obtained from responses to the questionnaires.

Seirei questionnaire of swallowing: This is a 15-item self-administered questionnaire that assesses the patient's swallowing status over the last couple of years. If the patient has difficulty completing the questionnaire, it can be completed by a family member. The 15 items include one item on the history of pneumonia, one item on the nutritional status, five items on the pharyngeal function, four items on the oral function, three items on the esophageal function, and one item on the glottic defense mechanism. The grading is as follows: A: severe and frequent symptoms; B: mild and infrequent symptoms; C: no symptoms. If there is at least one A in the patient's responses, the patient is considered to have dysphagia. If the patient has at least one B but no A, dysphagia is suspected; if the patient has only one C, dysphagia is considered unlikely.

Modified dysphagia risk assessment scale: This is a 23-item questionnaire that was developed to screen community-dwelling older adults for the risk of dysphagia based on subjective symptoms. The answers provide information on subjective symptoms while eating for the last three months or so. The 23 items consist of seven dysphagia items in the pharyngeal phase, five aspiration items and eight dysphagia items in the preparation and oral phases, and three dysphagia oral functions in the esophageal stage. Responses are scored as follows: 3 points: always; 2 points: sometimes; 1 point: rarely; and 0 points: almost never. A patient with a total score of 6 or more is considered to be at risk of dysphagia.

Eating assessment tool-10 (EAT-10): The questionnaire consists of 10 questions about subjective symptoms related to dysphagia. Each item is answered on a 5-point scale from 0 (no problem) to 4 (very problematic). Dysphagia is suspected in a patient with a total score of 3 or more.

The Mann assessment of swallowing ability (MASA): This assessment of swallowing function in acute stroke patients was developed in the U.S. in 2002. This screening test is used to determine aspiration and dysphagia.

Table 8: MASA

Score	Dysphagia	
178–200	Normal	No abnormalities in swallowing.
168–177	Mild dysphagia	Abnormality in at least one of the elements of swallowing that is delayed, impaired, or inadequate, which adversely affects bolus formation or transport and mildly increases the risk of dysphagia and aspiration.
139–167	Moderate dysphagia	Abnormalities in some of the elements of swallowing, such as delayed, impaired, or inadequate, leading to a moderate increase in the risk of dysphagia and aspiration.
Less than 138	Severe dysphagia	Five or more abnormalities (delayed, impaired, or inadequate) in the clinical assessment of swallowing that significantly increase the risk of dysphagia and aspiration. This includes direct observation of the respiratory impairment, choking, coughing, skin color changes, wet hoarseness, and delayed oral/pharyngeal transit time.
Score	Pulmonary aspiration	
170–200	No aspiration risk score	Swallowing abnormalities not identified.
149–169	Mild aspiration risk score	Abnormality in at least one of the elements of swallowing that is delayed, impaired, or inadequate, which adversely affects bolus formation or transport and mildly increases the risk of airway inflow of boluses.
141–148	Moderate aspiration risk score	Abnormalities in some of the elements of swallowing, such as delayed, impaired, or inadequate swallowing, with a moderately increased risk of airway inflow of food boluses.
140 or less	Severe aspiration risk score	Several (usually five or more) abnormalities (delayed, impaired, or inadequate) in the clinical assessment of swallowing significantly increase the risk of airway inflow of food boluses. Direct observation of respiratory impairment, including direct observation of choking, cyanosis, rattling sounds, or inadequate sputum.

The Japanese version of the MASA was developed in 2014 [18] and consists of 24 items. The items included are the swallowing organ function, awareness, cooperative behavior, auditory comprehension, aphasia, dysarthria, and respiratory function. The criteria for dysphagia and aspiration are presented in **Table 8**.

Furthermore, in recent years, screening for aspiration and pharyngeal residue during eating and swallowing has also been performed using ultrasound diagnostic devices and endoscopes.

With ultrasound diagnostic devices, it is possible to observe swallowing with echo images while food is being normally consumed and observe aspiration and pharyngeal residue by processing the images. In the case of aspiration and pharyngeal residue, the main areas to be imaged are the airway, pyriform fossa, and epiglottic valley. An ultrasound diagnostic device is a minimally invasive observation method that can be used to confirm the presence or absence of aspiration or pharyngeal residue. It is advisable to make observations with ultrasound diagnostic devices first and then proceed to endoscopic observations if more detailed observations are necessary. If aspiration, penetration, or pharyngeal residue is observed using ultrasound or endoscopy, care should be taken to prevent or alleviate aspiration, by adjusting the viscosity of food and liquids and the posture of eating and drinking and by suctioning the pyriform fossa.

During endoscopic observation, a nasopharyngeal fiberscope (electronic scope) is inserted transnasally to directly observe the pharyngeal cavity. This makes it possible to observe organic lesions, aspiration, penetration, and pharyngeal residues. In particular, when observing pharyngeal residues, it has the advantage that pharyngeal residues can be aspirated while directly observing the residue site. However, due to the endoscope's field of view and blind spots caused by the structure of the pharynx and larynx, it may not be possible to confirm aspiration in the airway.

(3) Scrutiny and comprehensive evaluation

Videoendoscopic examination of swallowing, VE:

A nasopharyngeal fiberscope (electronic scope) is inserted intranasally to observe morphological abnormalities,

swallowing dynamics, and the presence of aspiration or pharyngeal residue. In contrast to screening applications, the purpose of this examination is to diagnose and comprehensively evaluate dysphagia in general and determine the possibility of oral intake and compensatory methods for dysphagia in particular.

Videofluoroscopic examination of swallowing, VF:

Adjusted food mixed with a contrast agent was used, and its swallowing was observed using an X-ray fluoroscopy system. Similar to VE, morphological abnormalities, functional abnormalities, and pharyngeal residues can be observed, and aspiration can also be observed. VF can also be used to determine the eating conditions within which oral intake is possible and safe and compensatory methods for dysphagia. Compared to VE, it aids the observation of the entire space from the oral cavity to the esophagus; however, because of radiation exposure, the fluoroscopy time and frequency are limited, making it unsuitable for frequent observations.

Computed tomography, CT:

This is a method for observing the swallowing process with contrast-enhanced food using a continuous scanning method called the dynamic volume scan. By creating volume-rendered images of soft tissues, bones, airway surfaces, and contrast media, it is possible to make three-dimensional depictions and dynamic analysis of swallowing and observe morphological abnormalities, functional abnormalities, residues, and aspiration. The three-dimensional view allows the evaluation of laryngeal closure during swallowing, as well as the movement and timing of organs related to laryngeal closure. However, because of radiation exposure, the fluoroscopy time and frequency are limited, making it unsuitable for frequent observations.

Ultrasonography, US:

In contrast to screening applications, ultrasonography is used to assess muscle morphology and swallowing motion. Muscle morphology is evaluated in the tongue and suprahyoid muscle groups. For swallowing motion, the tongue movement, hyoid-laryngeal movement, and contraction of the perihyoid muscles during swallowing are evaluated.

Swallowing pressure test (Manometry):

This method captures the relaxation state of the esophageal inlet and pharyngeal contractility as changes in pressure. A catheter with a pressure transducer is inserted nasally through the pharynx and into the esophagus to measure the intra-pharyngeal and intra-esophageal pressures.

Electromyogram test:

This test evaluates the contractile state and activity patterns of the muscles involved in swallowing. Surface electromyography is commonly used in the fields of eating and swallowing. Surface electrodes are placed on the surface of the body where the muscles are to be checked for contraction, and the examinee is instructed to move the muscles voluntarily. The waveforms obtained are analyzed to evaluate the coordinated movements of the muscles.

Based on the above findings, it is possible to classify the severity of dysphagia and aspiration.

There are various severity classifications, but the most frequently used classifications in Japan include Dysphagia Severity Scale, Eating Status Scale, ability to swallow grade, and Food Intake Level Scale. The Functional Oral Intake Scale (FOIS) was developed in the U.S.

Dysphagia Severity Scale (DSS): A seven-level classification that assesses the oral and pharyngeal function. If there was no aspiration, the severity was categorized from 7 (normal range) to 5 (oral problems); if there was aspiration, the severity was categorized from 4 (opportunity aspiration) to 1 (salivary aspiration).

Eating status scale (ESS): This scale was developed to assess the oral and pharyngeal function with DSS and

evaluate the actual eating status. Medical stability was defined as the absence of problems related to aspiration pneumonia, choking, dehydration, or low nutrition in the past 1–2 months.

Ability to swallow grade: A 10-point scale that assesses the ability to swallow. Ten (normal ability to eat and swallow) is normal; 9 (able to take regular food orally, requires clinical observation and guidance) to 7 (swallows food, takes all three meals orally) is classified as mild (oral only); 6 (takes three meals orally plus supplemental nutrition) to 4 (able to three meals orally plus supplemental feeding; taken for pleasure) is classified as moderate (oral plus supplemental feeding), and 3 (aspiration can be reduced under the right conditions and intake training is possible) to 1 (has difficulty or inability to swallow, no indication for swallowing training) is classified as severe (non-oral).

Food Intake Level Scale (FILS): Developed by the same researchers who created the ability to swallow grade. The FILS is a 10-point scale based on observations of eating situations and daily intake. If a person is eating only orally and has no problems with swallowing, he or she is rated at level 10; at level 9 (no food restrictions, eating three meals orally) to level 7 (swallowing diet, eating all three meals orally) with mild problems. In the case of oral intake and alternative feeding, the patient is rated at level 6 (mainly taking three meals of swallowed food orally with alternative feeding for shortages) to level 4 (taking less than one meal of (fun level) swallowed food orally but mainly considers alternative feeding). If there is no oral intake, the patient is rated at level 3 (swallowing training with very small amounts of food) to level 1 (no swallowing training).

Functional Oral Intake Scale (FOIS): Assesses actual eating status. There are seven levels, ranging from level 7 (all oral intake without restriction) to level 1 (no oral intake).

Penetration-aspiration scale (PAS): There are eight levels; based on VF results, the depth of penetration and the presence or absence of expulsion of food are evaluated. If the food enters the airway but remains above the vocal cords, it is called penetration; if it crosses the vocal cords and enters the trachea, it is called aspiration. One indicates that food does not enter the airway; 2 (enters the airway above the vocal cords but is expelled from the airway) to 5 (enters the airway and touches the vocal cords but is not expelled from the airway) indicate penetration; 6 (enters the airway below the vocal cords but is expelled above the vocal cords) to 8 (enters the airway above the vocal cords but is expelled from the airway) indicate laryngeal penetration. Six (enters the airway below the vocal cords but exits above the vocal cords) to 8 (enters the airway below the vocal cords but does not cause swelling) are classified as aspiration, and 8 is subclinical aspiration.

5. Nursing care selection based on the assessment of aspiration and pharyngeal residue during eating and swallowing

Nursing care based on the assessment of aspiration and pharyngeal residue during eating and swallowing includes the prevention of aspiration pneumonia and eating and swallowing rehabilitation (swallowing training).

1) Prevention of aspiration pneumonia

Preventing aspiration associated with eating requires the adjustment of eating patterns, use of compensatory methods, such as posture, and appropriate assistance. Preventing aspiration due to saliva requires oral care and pyriform fossa aspiration to suction out the pharyngeal residue. It is also necessary to improve the ability to expectorate secretions, such as coughing, which is necessary in the event of aspiration.

2) Eating and swallowing rehabilitation (swallowing training)

Eating and swallowing rehabilitation is divided into indirect training without food and direct training with food, which is selected according to the type and severity of dysphagia.

Indirect training includes exercises for swallowing-related muscle groups and is essentially safe because it does not involve food. These include oral care, neck, mandibular, lip, tongue, and cheek exercises, cold pressure stimulation of the anterior palatal arch, head elevation exercises (Shaker exercises), blowing, and pushing and pulling exercises. Swallowing techniques are voluntary adjustments of some swallowing movements to promote safer swallowing, such as the Mendelsohn maneuver, supraglottic swallow, and effortful swallowing. Repeatedly performing these techniques can also increase muscle strength. Therefore, they should be repeated as indirect training until their effectiveness in preventing aspiration and pharyngeal retention is confirmed, after which they can be performed as part of direct training.

Direct training is conducted by ingesting food, with measures taken to prevent aspiration and residue to the maximum extent possible by adjusting the eating posture, food form, bite size, and swallowing method. The adjustment of eating patterns is determined based on assessment using screening tests and imaging studies, but the goal is to achieve chewing and swallowing as much as possible while paying attention to safety. This is because chewing produces saliva, which aids in food bolus formation and enhances taste sensation. In addition, it provides activity to the swallowing muscle groups.

To prevent aspiration, swallowing methods, such as awareness of swallowing; postures, such as head flexion and neck flexion; and breath-holding swallowing should be used. If there is pharyngeal residue, swallowing techniques such as turning the neck to the affected side (residue side) and guiding the food bolus to the healthy side (non-residue side) before swallowing, alternating liquid and solid swallowing, and multiple swallows are used. In addition, to remove pharyngeal residue after swallowing, the neck is rotated to the non-residue side, and empty swallowing is performed.

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Part 2.

Recommendation statements and systematic reviews for each CQ

CQ 1

It is advisable to perform a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia? To avoid duplication with CQs 3, 4, 5, and 6, assessments using only the Repetitive Saliva Swallowing Test (RSST), Modified Water Swallowing Test (MWST), Food Test (FT), or cervical auscultation were not included here.

1) Recommendations

○ We propose to conduct an assessment of aspiration through a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) for individuals aged 18 years and older, who are suspected of having dysphagia.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] When including observation items that require an understanding of instructional actions, such as command swallowing of water, care should be taken while applying the process to persons with impaired consciousness or severe cognitive impairment.

2) Background and purpose

In the field of swallowing rehabilitation, systematic assessment using physical assessment techniques (interview, visual examination, ausucultation, palpation, and percussion), which do not require special devices, can be easily performed at home and in treatment facilities and is widely used.

Physical assessment techniques are based on the integration of subjective and objective information. The subjective information was obtained from interviews with the patient and family members on topics related to the preceding, preparation, oral, pharyngeal, and esophageal phases, and on the general condition, including respiration and nutritional status. Based on the results of the interview, objective information is obtained from the physical assessment of the brain and nervous system (mainly olfactory, optic, trigeminal, facial, glossopharyngeal, vagus, accessory, and hypoglossal nerves), respiratory system, and nutritional status related to eating and swallowing, facial appearance, speech, lips, temporomandibular joint, oral cavity, tongue, soft palate, anterior palatine arch, oral sensation, larynx, trachea, lungs, and general condition. Physical assessment includes visual, palpatory, auscultatory, and percussion examinations[1].

Physical assessment techniques are often performed before screening tests, such as RSST, MWST, FT, and cough test. Physical assessment of the cerebral nervous system, respiratory system, etc. can assess the eating and swallowing function of the recuperators with impaired consciousness or cognitive impairment who have difficulty understanding instructional actions. However, physical assessment techniques used in actual clinical practice vary in terms of the person performing the examination and the content, and the sensitivity and specificity of the assessment are not clear. In this guideline, we examined the sensitivity and specificity of the assessment of dys-

phagia using physical assessment techniques from domestic and international literature. The reference standard for confirming sensitivity and specificity was VF or VE.

3) Explanation

This systematic review searched for the sensitivity and specificity of the assessment of dysphagia using physical assessment techniques. Cross-sectional observational studies or cohort studies were selected. Twenty-three articles were included in this systematic review. Of these, 22 articles used sensitivity and specificity as outcomes in the detection of aspiration,[2)-23)] and one study used sensitivity and specificity as outcomes in the prediction of pneumonia.[24)] There were no relevant articles that used the sensitivity and specificity of pharyngeal residue detection as an outcome. Of the 22 articles that used sensitivity and specificity as outcomes for aspiration detection, three used the MASA,[7), 11), 21)] and two used TOR_BSST, [17), 22)] and oxygen saturation was used as a criterion in two studies[3), 17)]. With regard to objective information, lip closure, tongue movement, voice quality, laryngeal elevation, cough, consciousness level, cognitive function, history of pneumonia, food intake, voluntary swallowing, dysarthria, pharyngeal reflexes, nasopharyngeal closure, occlusion, facial expression, tongue muscle strength, oral residue, liveliness, choking when swallowing water or food, and changes in voice quality were used as indicators. In the literature, the outcomes were the sensitivity and specificity of detection of the onset of pneumonia, and the indicators were the palatal reflex* (stimulation of the anterior palatal arch and observation of the elevation of the soft palate), laryngeal movement, pharyngeal residue, lip closure, and tongue movement.

*In addition to the swallowing reflex, other reflexes triggered by the stimulation of the oral cavity and pharynx are the palatoglossal and pharyngeal strangulation reflexes. Pharyngeal strangulation reflex: Pressing the root of the tongue or the pharyngeal mucosa with a tongue depressor causes the pharynx to close due to contraction of the pharyngeal contractile muscles, elevation of the soft palate, and retraction of the tongue.

We conducted a meta-analysis of 22 studies using sensitivity and specificity as outcomes in the detection of aspiration. The integrated sensitivity was 0.82 (95% confidence interval [CI]: 0.72–0.89) and specificity was 0.76 (95% CI: 0.69–0.83). Here, we conducted a meta-analysis by dividing the literature into [2)-6), 8), 9), 12)-15), 17)-23)], which included observations that required understanding of instructions, such as swallowing water orders, food swallowing, and medical interviews, and [7), 10), 11), 16)], which did not include observations that required understanding of instructions. We calculated the integrated sensitivity and specificity of aspiration detection. The physical examination techniques used in each study are summarized in **Table 1**. As a result, there were 18 references that included observation items requiring instructional understanding, with an integrated sensitivity of 0.84 (95% CI: 0.74–0.91) and specificity of 0.71 (95% CI: 0.64–0.77). There were four references that did not include observations requiring instructional comprehension, with an integrated sensitivity of 0.64 (95% CI: 0.32–0.88) and specificity of 0.91 (95% CI: 0.82–0.97). For intra-rater reliability, TOR_BSST had an intraclass correlation coefficient of 0.92. For inter-rater reliability, the kappa coefficient for MASA was 0.75. No other physical assessment techniques for intra- or inter-rater reliability have been described in the literature.

In one study with pneumonia as the outcome, the sensitivity and specificity on the second day of hospitalization were 0.86 and 0.71, respectively, and those on the fourth day of hospitalization were 0.75 and 0.67, respectively[24)]. The inter-rater agreement for each measure ranged from 82.0 to 95.3%.

In the assessment of aspiration using physical assessment techniques, when observation items that require an understanding of instructions, such as water swallowing tests, are included, the sensitivity is higher but the specificity is lower than when they are not included. In predicting the onset of pneumonia, both sensitivity and speci-

Table 1: List of physical assessment techniques used in the paper

Paper	Physical assessment technique
Mann, 2000 [21]	MASA
González, 2011 [7]	MASA
Ohira, 2017 [11]	MASA
Toscano, 2019 [17]	Water swallowing test (TOR_BSST), laryngeal elevation, SpO_2
Martino, 2009 [22]	Water swallowing test (TOR_BSST)
Ramsey, 2006 [3]	Lip closure, tongue movement, voice quality, water swallowing test, SpO_2
Yousovich, 2018 [4]	Cough, voice quality, choking (water swallowing test)
Newton, 1994 [19]	Subjective symptoms, level of consciousness, water swallowing test
Baylow, 2009 [2]	Observation of 28 items, including history of pneumonia, oral and pharyngeal stages, and water swallowing test
Baumann, 2017 [13]	Oral function, voice quality, water swallowing test
Smith, 2009 [15]	Cognitive function, cough, water swallowing test
Vogel, 2017 [5]	Interview, medical history, intake status, water swallowing test
Zhou, 2011 [8]	Neurological findings, voluntary swallowing, dysarthria, pharyngeal reflexes, palatal closure, water swallowing test
Mandysova, 2011 [9]	Occlusion, tongue, facial muscles, shoulders, water swallowing test
Edmiaston, 2014 [18]	Level of consciousness, facial muscles, tongue, palate, water swallowing test
Branco, 2019 [20]	Lip closure, leakage from lips, prolonged oral phase, oral retention, multiple swallows, laryngeal elevation, cervical auscultation, water swallowing test
Daniels, 1997 [6]	Facial appearance, lips, temporomandibular joint, tongue, curtain signs, voice, articulation, gag reflex, coughing, cough after swallowing, water swallowing test
Nishiwaki, 2005 [12]	Lip closure, tongue movement, palate, pharyngeal reflexes, voice quality (water swallowing test), speech function Figures represent the results of the water swallowing test only.
Daniels, 2016 [16]	Vitality, dysarthria, voice quality, cough, water swallowing test
Hey, 2013 [14]	Three of the following: organic dysarthria, wet hoarseness, tongue movement, and tongue muscle strength.
Keage, 2017 [10]	Pharyngeal reflexes, respiration, lip, palate, laryngeal function, tongue, cognition
Mortensen, 2016 [23]	Facial observation, saliva swallowing
Yamane, 2015 [24]	Palatal reflex, laryngeal movement, pharyngeal residue, lip closure, tongue movement

ficity are high on the second day of hospitalization but not that high on the fourth day of hospitalization. The different studies have different evaluation indices, and there is a large variation in sensitivity and specificity depending on the evaluation index and evaluator. The studies also included cases in which the evaluator of the physical examination technique performed the reference standard, VF or VE, and cases in which the VF or VE evaluator knew the results of the physical examination technique; this incorporated a risk of bias. When the outcome was sensitivity and specificity of aspiration, both imprecision and publication bias were judged to be "none." When the outcome was the sensitivity and specificity of predicting the development of aspiration pneumonia, both imprecision and publication bias were judged to be "unlikely." Based on the above, the certainty of the evidence was judged to be "weak."

In addition to the certainty of the evidence, the main issues discussed at the panel meeting to determine the recommendation were cost, the willingness of the target population, burden on the target population, reliability and feasibility of the assessment methods, and non-directiveness of the studies included in the systematic review. Physical assessment techniques cost little when performed without test foods and are less painful for patients. The risk of aspiration is also very low when observations are made without the use of fluids or food. In addition, unless the food used is not to the patient's preference, it is unlikely that the use of physical assessment techniques will deviate significantly from the patient's wishes. However, the reliability and feasibility of the results should be considered with caution because the physical examination technique requires experience and education, and in a study that was the subject of the systematic review, the person who conducted the assessment was a speech-lan-

guage-hearing therapist, and the study was mainly conducted on acute stroke patients. Results of the voting indicated that five of the seven members voted for a "weak recommendation for implementation" and two voted for a "strong recommendation for implementation," with 71% in favor of a "weak recommendation for implementation." The wording of the recommendation was: "We propose to conduct an assessment of aspiration through a systematic assessment using physical assessment techniques."

The facilitating factor in the application of this clinical practice guideline is that physical assessment techniques can be performed without the use of special devices. The disincentive is that it requires experience and education to conduct the assessment.

4) Database search results

Aspiration pneumonia, aspiration, bedside assessment, bedside evaluation, bedside screen, clinical assessment, deglutition disorder, dysphagia, physical assessment, physical examination, pneumonia, predictive value, (dysphagia, swallowing pneumonia, aspiration pneumonia, attracted pneumonia, physical examination, physical examination, screening, pneumonia-swallowing, assessment, physical assessment, bedside assessment, physical examination [in Japanese]) were used as keywords. The databases included PubMed (until August 31, 2019), Embase (until August 31, 2019), CINAHL (until August 31, 2019), Cochrane Library (until August 31, 2019), and Ichushi-Web (until August 31, 2019). As a result, 1090 studies were identified, and 23 observational studies were recruited after screening. The database search formulas are included in the appendix.

5) Literature search flowchart

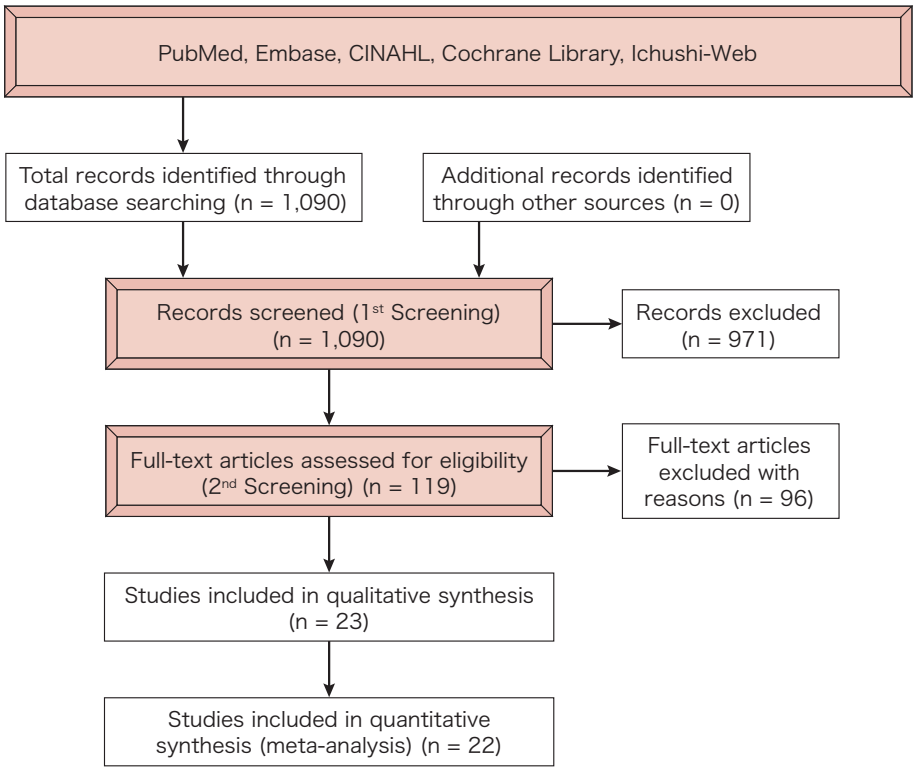

Figure 1: Literature search flowchart

6) List after secondary screening

Table 2: List after secondary screening

Literature	Design	P	Index test	Reference standard	O	Exclusion	Comment
Ramsey, 2006	Cross-sectional study	Patients in the acute stage of stroke	Lip closure, tongue movement, voice quality, water swallowing test, SPO_2	VF	Sensitivity and specificity of aspiration detection		
Toscano, 2019	Cross-sectional study	Patients within 72 hours after stroke onset	TOR_BSST, laryngeal elevation, SPO_2	VE	Sensitivity and specificity of aspiration detection		
Martino, 2009	Cross-sectional study	Stroke patients	TOR_BSST	VF	Sensitivity and specificity of aspiration detection		
Mann, 2000	Cohort study	Patients with first-ever and acute stroke	MASA	VF	Sensitivity and specificity of aspiration detection		
González, 2011	Cross-sectional study	Patients with dysphagia	MASA	VF	Sensitivity and specificity of aspiration detection		
Ohira, 2017	Cross-sectional study	Patients who have suffered a brain injury (including trauma and stroke)	MASA	VF	Sensitivity and specificity of aspiration detection		
Yousovich, 2018	Cross-sectional study	Patients with dysphagia	Cough, voice quality, choking (water swallowing test)	VE	Sensitivity and specificity of aspiration detection		
Newton, 1994	Cross-sectional study	Brain tumor patients with dysphagia	Subjective symptoms, level of consciousness, water swallowing test	VF	Sensitivity and specificity of aspiration detection		
Baylow, 2009	Cross-sectional study	Patients in the acute stage of stroke	Observation of 28 items, including the history of pneumonia, oral and pharyngeal stages, and water swallowing test	VF	Sensitivity and specificity of aspiration detection		
Baumann, 2017	Cross-sectional study	Patients after lung transplantation	Oral function, voice quality, water swallowing test	VE/VF	Sensitivity and specificity of aspiration detection		
Smith, 2009	Cross-sectional study	Ischemic stroke patients	Cognitive function, cough, water swallowing test	VE/VF	Sensitivity and specificity of aspiration detection		
Vogel, 2017	Cross-sectional study	Neurodegenerative disease patients	Interview, medical history, intake status, water swallowing test	VF	Sensitivity and specificity of aspiration detection		
Zhou, 2011	Cross-sectional study	Stroke patients	Neurological findings, voluntary swallowing, dysarthria, pharyngeal reflex, palatal closure, water swallowing test	VF	Sensitivity and specificity of aspiration detection		
Mandysova, 2011	Cross-sectional study	Patients with dysphagia	Occlusion, tongue, facial muscles, shoulders, water swallowing test	VE	Sensitivity and specificity of aspiration detection		
Hey, 2013	Cross-sectional study	Postoperative patients with head and neck cancer	Three of the following: organic dysarthria, wet hoarseness, tongue movement, and tongue muscle strength	VE	Sensitivity and specificity of aspiration detection		
Edmiaston, 2014	Cross-sectional study	Acute stroke patients	Level of consciousness, facial muscles, tongue, palate, water swallowing test	VF	Sensitivity and specificity of aspiration detection		
Branco, 2019	Cross-sectional study	Patients with Parkinson's disease	Lip closure, leakage from lips, prolonged oral phase, oral retention, multiple swallows, laryngeal elevation, cervical auscultation, water swallowing test	VF	Sensitivity and specificity of aspiration detection		
Daniels, 1997	Cross-sectional study	Patients in the acute stage of stroke	Facial appearance, lips, TMJ, tongue, curtain signs, voice, articulation, gag reflex, coughing, cough after swallowing, water swallowing test	VF	Sensitivity and specificity of aspiration detection		
Nishiwaki, 2005	Cross-sectional study	Stroke patients	Lip closure, tongue movement, palate, pharyngeal reflex, voice quality (water swallowing test), speech function. Aspiration detection sensitivity and specificity are based on the results of the water swallowing test only.	VF	Sensitivity and specificity of aspiration detection		
Kaege, 2017	Cross-sectional study	Patients with Friedreich's ataxia	Pharyngeal reflex, respiration, lip, palate, laryngeal function, tongue, cognition	VF	Sensitivity and specificity of aspiration detection		
Daniels, 2016	Cross-sectional study	Patients suspected of having stroke	Vitality, dysarthria, voice quality, cough, water swallowing test	VF	Sensitivity and specificity of aspiration detection		
Mortensen, 2016	Cross-sectional study	Patients with head trauma	Facial observation, saliva swallowing	VE	Sensitivity and specificity of aspiration detection		
Yamane, 2015	Cohort study	Patients in the acute stage of stroke	Palatal reflex, laryngeal movement, pharyngeal residue, lip closure, tongue movement	Blood test, radiograph, and CT	Sensitivity and specificity of risk determination for aspiration pneumonia		

7) List of included papers

Table 3: List of included papers

Included papers	Ramsey DJC, Smithard DG, Kalra L.	Can pulse oximetry or a bedside swallowing assessment be used to detect aspiration after stroke? Stroke 2006; 37(12): 2984-2988.
Included papers	Baylow HE, Goldfarb R, Taveira CH, et al.	Accuracy of clinical judgment of the chin-down posture for dysphagia during the clinical/bedside assessment as corroborated by videofluoroscopy in adults with acute stroke. Dysphagia 2009; 24(4): 423-433.
Included papers	Yousovich R, Levi A, Kaplan D, et al.	The clinical "bedside" assessement of the dysphagia patient differences with food and fluids intake. Dysphagia 2018; 33(4): 533. Abstract
Included papers	Vogel AP, Rommel N, Sauer C, et al.	Clinical assessment of dysphagia in neurodegeneration (CADN): development, validity and reliability of a bedside tool for dysphagia assessment. J Neurol 2017; 264(6): 1107-1117.
Included papers	Daniels SK, McAdam CP, Briley K, et al.	Clinical assessment of swallowing and prediction of dysphagia severity. Am J Speech-Language Pathol 1997; 6(4): https://doi.org/10.1044/1058-0360.0604.17
Included papers	Gonzalez-Fernandez M, Sein MT, Palmer JB.	Clinical experience using the Mann assessment of swallowing ability for identification of patients at risk for aspiration in a mixed-disease population. Am J Speech-Language Pathol 2011; 20(4): 331-336.
Included papers	Zhou Z, Salle J, Daviet J, et al.	Combined approach in bedside assessment of aspiration risk post stroke: PASS. Eur J Phys Rehabil Med 2011; 47(3): 441-446.
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Included papers	Ohira M, Ishida R, Maki Y, et al.	Evaluation of a dysphagia screening system based on the Mann assessment of swallowing ability for use in dependent older adults. Geriatr Gerontol Int 2017; 17(4): 561-657.
Included papers	Nishiwaki K, Tsuji T, Liu M, et al.	Identification of a simple screening tool for dysphagia in patients with stroke using factor analysis of multiple dysphagia variables. J Rehabil Med 2005; 37(4): 247-251.
Included papers	Baumann B, Byers S, Wasserman-Wincko T, et al.	Postoperative swallowing assessment after lung transplantation. Annal Thoracic Surg 2017; 104(1): 308-312.
Included papers	Hey C, Lange BP, Aere C, et al.	Predictability of oral and laryngopharyngeal function for aspiration and limitation of oral intake in patients after surgery for head and neck cancer. Anticancer Res 2013; 33(8): 3347-3353.
Included papers	Smith Hammond CA, Goldstein LB, Horner RD, et al.	Predicting aspiration in patients with ischemic stroke: comparison of clinical signs and aerodynamic measures of voluntary cough. Chest 2009; 135(3): 769-777.
Included papers	Daniels SK, Pathak S, Rosenbek JC, et al.	Rapid aspiration screening for suspected stroke: Part 1: development and validation. Arch Phys Med Rehabil 2016; 97(9): 1440-1448.
Included papers	Toscano M, Vigano A, Rea A, et al.	Sapienza global bedside evaluation of swallowing after stroke: the GLOBE-3S study. Eur J Neurol 2019; 26(4): 596-602.
Included papers	Edmiaston J, Connor LT, Steger-May K, et al.	A simple bedside stroke dysphagia screen, validated against videofluoroscopy, detects dysphagia and aspiration with high sensitivity. J Stroke Cerebrovasc Dis 2014; 23(4): 712-716.
Included papers	Newton HB, Newton C, Pearl D, et al.	Swallowing assessment in primary brain tumor patients with dysphagia. Neurology 1994; 44(10): 1927-1932.
Included papers	Branco LL, Trentin S, Augustin Schwanke CH, et al.	The swallowing clinical assessment score in parkinson's disease (SCAS-PD) is a valid and low-cost tool for evaluation of dysphagia: A gold-standard comparisons study. J Aging Res 2019; 7984635.
Included papers	Mann G, Hankey GJ, Cameron D.	Swallowing disorders following acute stroke: prevalence and diagnostic accuracy. Cerebrovasc Dis 2000; 10(5): 380-386.
Included papers	Martino R, Silver F, Teasell R, et al.	The toronto bedside swallowing screening test (TOR-BSST) development and validation of a dysphagia screening tool for patients with stroke. Stroke 2009; 40(2): 555-561.
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Included papers	Daniels SK, Pathak S, Rosenbek JC, et al.	Rapid Aspiration Screening for Suspected Stroke: Part 1: Development and Validation. Arch Phys Med Rehabil 2016; 97(9): 1440-1448.
Included papers	Yamane Y, Kamakura Y, Fukada J, et al.	Development of a Risk Assessment Algorithm for Aspiration Pneumonia in Acute Stroke. J Jpn Soc Feed Swallow Rehabil 2015; 19(3):201-213.

8) Qualitative systematic review

Table 4: Qualitative systematic review

CQ	1	It is advisable to perform a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia? To avoid duplication with CQs 3, 4, 5, and 6, assessments using only the Repetitive Saliva Swallowing Test (RSST), Modified Water Swallowing Test (MWST), Food Test (FT), or cervical auscultation were not included here.
P		Persons aged 18 years and older suspected of having dysphagia
I		Physical assessment techniques
C		VF or VE
Clinical context		Physical assessment techniques are based on the integration of subjective and objective information. The subjective information is obtained from the medical history of the patient and family members, the medical history of the preceding, preparation, oral, pharyngeal, and esophageal phases, and the medical history of the general condition, including respiration and nutritional status. Based on the results of these interviews, objective information is obtained from physical examinations of the brain and nervous system (mainly olfactory, optic, trigeminal, facial, glossopharyngeal, vagus, accessory, and hypoglossal nerves), respiratory system, nutritional status related to eating and swallowing, facial appearance, speech, lips, temporomandibular joint, oral cavity, tongue, soft palate, anterior palatal arch, oral sensation, larynx, trachea, lungs, and the general condition. Physical assessment techniques are often performed prior to screening tests, such as RSST (Repetitive Saliva Swallowing Test), MWST (Modified Water Swallowing Test), FT (Food Test), and cough test. They can also be used to assess the swallowing function in patients with impaired consciousness or cognitive impairment.
O1		True positives, true negatives, false positives, and false negatives in aspiration detection
Summary of indirectness		Decided "none."
The risk of bias summary		The risk of bias was "unlikely" because the examiners may have not been blinded or it is not clear if they were blinded from the index test or reference standard results.
Inconsistency and other summary		Sensitivity and specificity varied, and inconsistency was "unlikely."
Comment		Of the 22 references that used sensitivity and specificity as outcomes for aspiration detection, three used MASA (The Mann Assessment of Swallowing Ability),[7), 11), 21)] and two used TOR_BSST (Toronto Bedside Swallowing Screening Test) [17), 22)], and oxygen saturation was used as a criterion in two studies[3), 17)]. As for objective information, the following indicators were recorded: lip closure, tongue movement, voice quality, laryngeal elevation, cough, the level of consciousness, cognitive function, the history of pneumonia, food intake, voluntary swallowing, dysarthria, pharyngeal reflex, nasopharyngeal closure, occlusion, facial expression, tongue muscle strength, oral residue, coughing, liveliness, swallowing function when swallowing water or food, and changes in voice quality.
O2		True positives, true negatives, false positives, and false negatives in determining risk for aspiration pneumonia
Summary of indirectness		Decided "none."
The risk of bias summary		Bias risk was judged to be "unlikely."
Inconsistency and other summary		It was determined to be "unlikely" because there was only one target paper.
Comment		In one study reporting pneumonia as the outcome, the sensitivity and specificity for the outcome on the second day of hospitalization were 0.86 and 0.71, respectively, and on the fourth day of hospitalization, the sensitivity and specificity were 0.75 and 0.67, respectively[20)]. The inter-rater agreement for each measure ranged from 82.0–95.3%.

9) Meta-analysis

We conducted a meta-analysis of 22 studies using the sensitivity and specificity of aspiration detection as outcomes. The integrated sensitivity was 0.82 (95% CI: 0.72–0.89) and specificity was 0.76 (95% CI: 0.69–0.83) (**Figure 2**). Here, we conducted a meta-analysis of the literature that included observations that required understanding of instructions, such as command water swallowing, food swallowing, and interview [2)-6), 8), 9), 12)-15), 17)-23)],, and those that did not include observations that required understanding of instructions. [7), 10), 11), 16)] We calculated the integrated sensitivity and specificity of the aspiration detection. The physical assessment items in each study are summarized in a table. As a result, there were 18 references that included observation items that required an understanding of instructions, with an integrated sensitivity of 0.84 (95% CI: 0.74–0.91) and specificity of 0.71

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Baumann 2017	59	101	40	97	0.60 [0.49, 0.69]	0.49 [0.42, 0.56]
Baylow 2009	2	5	3	20	0.40 [0.05, 0.85]	0.80 [0.59, 0.93]
Branco 2019	7	3	0	18	1.00 [0.59, 1.00]	0.86 [0.64, 0.97]
Daniels 1997	24	11	2	22	0.92 [0.75, 0.99]	0.67 [0.48, 0.82]
Edmiaston 2014	57	81	3	82	0.95 [0.86, 0.99]	0.50 [0.42, 0.58]
González 2011	36	12	5	73	0.88 [0.74, 0.96]	0.86 [0.77, 0.92]
Hey 2013_2	28	13	16	23	0.64 [0.48, 0.78]	0.64 [0.46, 0.79]
Mandysova 2011	27	33	4	23	0.87 [0.70, 0.96]	0.41 [0.28, 0.55]
Mann 2000	26	37	2	63	0.93 [0.76, 0.99]	0.63 [0.53, 0.72]
Martino 2009	22	14	4	28	0.85 [0.65, 0.96]	0.67 [0.50, 0.80]
Keage 2017	8	5	4	21	0.67 [0.35, 0.90]	0.81 [0.61, 0.93]
Mortensen 2016	10	4	1	28	0.91 [0.59, 1.00]	0.88 [0.71, 0.96]
Newton 1994	8	1	0	3	1.00 [0.63, 1.00]	0.75 [0.19, 0.99]
Nishiwaki 2005	13	5	14	29	0.48 [0.29, 0.68]	0.85 [0.69, 0.95]
Ohira 2017	15	3	5	27	0.75 [0.51, 0.91]	0.90 [0.73, 0.98]
Ramsey 2006	6	12	1	35	0.86 [0.42, 1.00]	0.74 [0.60, 0.86]
Smith 2009	19	11	14	52	0.58 [0.39, 0.75]	0.83 [0.71, 0.91]
Daniels 2016	27	2	126	95	0.18 [0.12, 0.25]	0.98 [0.93, 1.00]
Toscano 2019	28	5	0	17	1.00 [0.88, 1.00]	0.77 [0.55, 0.92]
Vogel 2017	16	19	3	42	0.84 [0.60, 0.97]	0.69 [0.56, 0.80]
Yousovich 2018 pure	31	11	6	58	0.84 [0.68, 0.94]	0.84 [0.73, 0.92]
Zhou 2011	48	10	6	43	0.89 [0.77, 0.96]	0.81 [0.68, 0.91]
Total	518	398	259	899	0.82 [0.72, 0.89]	0.76 [0.69, 0.83]

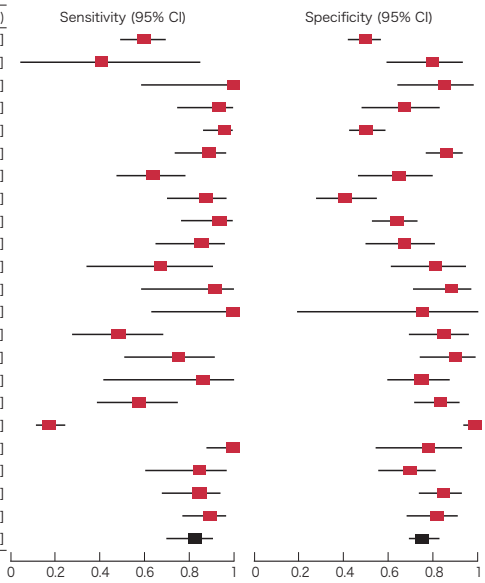

Figure 2: Comparison of the sensitivity and specificity of screening for aspiration using physical assessment techniques

Note: TP, true positive; FP, false positive; FN, false negative; TN, true negative.

In cases where two or more results from physical assessment techniques were presented, the value with the best sensitivity and specificity was incorporated into the analysis.

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Baumann 2017	59	101	40	97	0.60 [0.49, 0.69]	0.49 [0.42, 0.56]
Baylow 2009	2	5	3	20	0.40 [0.05, 0.85]	0.80 [0.59, 0.93]
Branco 2019	7	3	0	18	1.00 [0.59, 1.00]	0.86 [0.64, 0.97]
Daniels 1997	24	11	2	22	0.92 [0.75, 0.99]	0.67 [0.48, 0.82]
Edmiaston 2014	57	81	3	82	0.95 [0.86, 0.99]	0.50 [0.42, 0.58]
Hey 2013_2	28	13	16	23	0.64 [0.48, 0.78]	0.64 [0.46, 0.79]
Mandysova 2011	27	33	4	23	0.87 [0.70, 0.96]	0.41 [0.28, 0.55]
Mann 2000	26	37	2	63	0.93 [0.76, 0.99]	0.63 [0.53, 0.72]
Martino 2009	22	14	4	28	0.85 [0.65, 0.96]	0.67 [0.50, 0.80]
Mortensen 2016	10	4	1	28	0.91 [0.59, 1.00]	0.88 [0.71, 0.96]
Newton 1994	8	1	0	3	1.00 [0.63, 1.00]	0.75 [0.19, 0.99]
Nishiwaki 2005	13	5	14	29	0.48 [0.29, 0.68]	0.85 [0.69, 0.95]
Ramsey 2006	6	12	1	35	0.86 [0.42, 1.00]	0.74 [0.60, 0.86]
Smith 2009	19	11	14	52	0.58 [0.39, 0.75]	0.83 [0.71, 0.91]
Toscano 2019	28	5	0	17	1.00 [0.88, 1.00]	0.77 [0.55, 0.92]
Vogel 2017	16	19	3	42	0.84 [0.60, 0.97]	0.69 [0.56, 0.80]
Yousovich 2018 water	24	14	13	55	0.65 [0.47, 0.80]	0.80 [0.68, 0.88]
Zhou 2011	48	10	6	43	0.89 [0.77, 0.96]	0.81 [0.68, 0.91]
Total	424	379	126	680	0.84 [0.74, 0.91]	0.71 [0.64, 0.77]

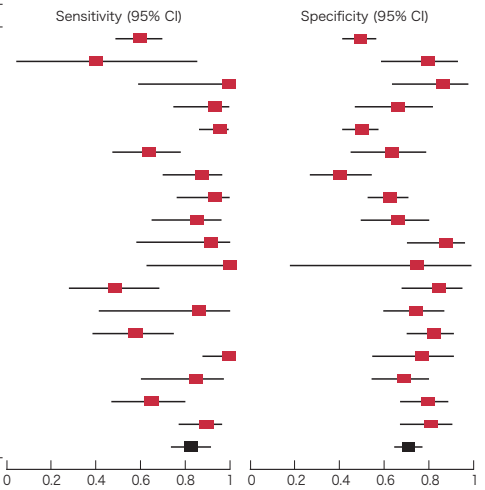

Figure 3: Comparison of sensitivity and specificity of screening for aspiration using physical assessment techniques. (In cases that include indicators that require the understanding of instructions, such as water swallowing tests)

Note: TP, true positive; FP, false positive; FN, false negative; TN, true negative.

(95% CI: 0.64–0.77) (**Figure 3**). There were four references that did not include observations requiring understanding of instructions, with an integrated sensitivity of 0.64 (95% CI: 0.32–0.88) and specificity of 0.91 (95% CI: 0.82–0.97) (**Figure 4**).

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
González 2011	36	12	5	73	0.88 [0.74, 0.96]	0.86 [0.77, 0.92]
Keage 2017	8	5	4	21	0.67 [0.35, 0.90]	0.81 [0.61, 0.93]
Ohira 2017	15	3	5	27	0.75 [0.51, 0.91]	0.90 [0.73, 0.98]
Daniels 2016	27	2	126	95	0.18 [0.12, 0.25]	0.98 [0.93, 1.00]
Total	86	22	140	216	0.64 [0.32, 0.88]	0.91 [0.82, 0.97]

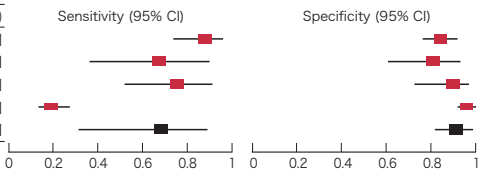

Figure 4: Comparison of the sensitivity and specificity of screening for aspiration using physical assessment techniques. (In cases that do not include indicators that require the understanding of instructions, such as water swallowing tests)

Note: TP, true positive; FP, false positive; FN, false negative; TN, true negative.

References

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2. Baylow HE, Goldfarb R, Taveira CH, et al. Accuracy of clinical judgment of the chin-down posture for dysphagia during the clinical/bedside assessment as corroborated by videofluoroscopy in adults with acute stroke. Dysphagia 2009; **24**(4): 423-433.
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23. Mortensen J, Jensen D, Kjaersgaard A. A validation study of the facial-oral tract therapy swallowing assessment of saliva. Clin Rehabil 2016; **30**(4): 410-415.
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2. CQ 2

CQ 2

Is it advisable to manage oropharyngeal dysphagia based on a systematic assessment using physical assessment techniques (interview, visual inspection, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia. To avoid duplication with CQs 3, 4, 5, and 6, assessments using only Repetitive Saliva Swallowing Test (RSST), Modified Water Swallowing Test (MWST), Food Test (FT), or cervical auscultation were not included here.

1) Recommendations

○ We propose to manage oropharyngeal dysphagia based on a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] Subsequent screening and diagnostic tests based on a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) are necessary for the implementation of appropriate care.

2) Background and purpose

Physical assessment techniques, which do not require special devices for swallowing rehabilitation, can be easily performed at home and in treatment facilities, and are widely used.

Physical assessment techniques are methods used for assessing the eating and swallowing function based on daily observations and are performed by integrating subjective and objective information. Subjective information is obtained by interviewing patients and their family members about the medical history, preceding, preparation, oral, pharyngeal, and esophageal phases, and general conditions, such as breathing and nutritional status. Based on the results of these interviews, objective information is obtained from physical examinations of the brain and nervous system (mainly olfactory, optic, trigeminal, facial, glossopharyngeal, vagus, hypoglossal, and accessory nerves), respiratory system, nutritional status related to eating and swallowing, facial appearance, speech, lips, temporomandibular joint, oral cavity, tongue, soft palate, anterior palatal arch, and oral sensation. Information on the larynx, trachea, and lungs, and the general condition is obtained from visual, palpatory, and auscultatory examinations.[1)]

Physical assessment techniques are often performed prior to screening tests, such as RSST, MWST, FT, and cough test. Physical examinations of the cerebral nervous and respiratory systems can evaluate the eating and swallowing functions of recuperators with impaired consciousness or cognitive impairment who have difficulty in performing directed movements.

However, the physical assessment techniques used in clinical practice vary in terms of who performs them and what they include, and it is not clear whether they contribute to patient outcomes. We investigated the effective-

ness of these techniques.

3) Explanation

The main selection criterion for the evidence was the type of study; randomized controlled trials were included. Observational studies were also included if there were no studies that met the recruitment criteria. The article used for this systematic review was one randomized controlled trial.[2] Physical examination techniques were established as the standard of care for the control group rather than the intervention group. Physical assessment techniques used in the control group included a history and oral motor assessment by SLPs, followed by bedside oral and pharyngeal swallowing assessments. Oral intake trials based on the physical examination results and VF referrals were then conducted as needed. The incidence of pneumonia within 3 months was 1.0% in the intervention group and 3.2% in the control group, with a relative risk of 0.32 (95% CI: 0.06–1.62). In the randomized controlled trial, there was no difference in the incidence of pneumonia between the intervention and control groups.

Although no standardized physical examination technique was provided, it was noted that a detailed neurological and oral motor assessment, including recording the history, voluntary coughing, and palpation of the hyoid bone and laryngeal elevation, was performed by clinically experienced SLPs. These findings suggested that appropriate care interventions based on information obtained from physical assessment could reduce the incidence of pneumonia. Because there was only one relevant study, the imprecision was judged to be "medium/doubtful (-1)" and the publication bias was judged to be "low (0)."

MASA[3] has been widely used in the U.S. and Australia for a long time as a physical assessment technique, and hence, can be used as a reference.

In addition to the certainty of the evidence, the main issues discussed at the panel meeting to determine recommendations were cost, subject intent, the burden on the subject, reliability and feasibility of the assessment methods, and indirectness of the studies included in the systematic review. In a previous study, SLPs were included as assessors, and the study was conducted on acute stroke patients; therefore, the results need to be generalized for other subjects. Besides, it is necessary to consider that physical assessment techniques require experience and education. Except in a case where the food provided does not suit the preferences of the patient, it is unlikely that the implementation of the physical examination technique will deviate greatly from the intentions of the patient. As a result, five out of eight participants voted for "weak recommendation to implement," two voted for "strong recommendation to implement," and one voted for "no recommendation." The recommendation "weak recommendation for implementation" was worded as "we suggest that assessment-based management for oropharyngeal dysphagia be provided."

The facilitating factor in the application of this guideline is that physical assessment techniques can be performed without the use of special devices. The disadvantage, however, is that conducting the assessment requires experience and education.

Based on the above, the recommendation and certainty of evidence for this CQ were assigned GRADE 2C (strength of recommendation: weak, certainty of evidence (strength): weak).

4) Database search results

Aspiration pneumonia, aspiration, bedside assessment, bedside screen, deglutition disorder, deglutition disorder, deglutition, swallow, dysphagia, physical assessment, physical examination, pneumonia, (swallowing, swal-

lowing function assessment, dysphagia, swallowing pneumonia, aspiration in the airway, aspiration pneumonia, care, aspiration, aspiration pneumonia, residual, physical examination, screening, pneumonia-aspiration, physical assessment, bedside assessment, physical examination, screening [in Japanese]) were used as keywords. PubMed (until August 31, 2019), Embase (until August 31, 2019), CINAHL (until August 31, 2019), Cochrane Library (until August 31, 2019), and Ichushi-Web (until August 31, 2019), were used. As a result, 996 studies were identified, and one randomized controlled trial was conducted after screening. The database search formulae are included in the appendix.

5) Literature search flowchart

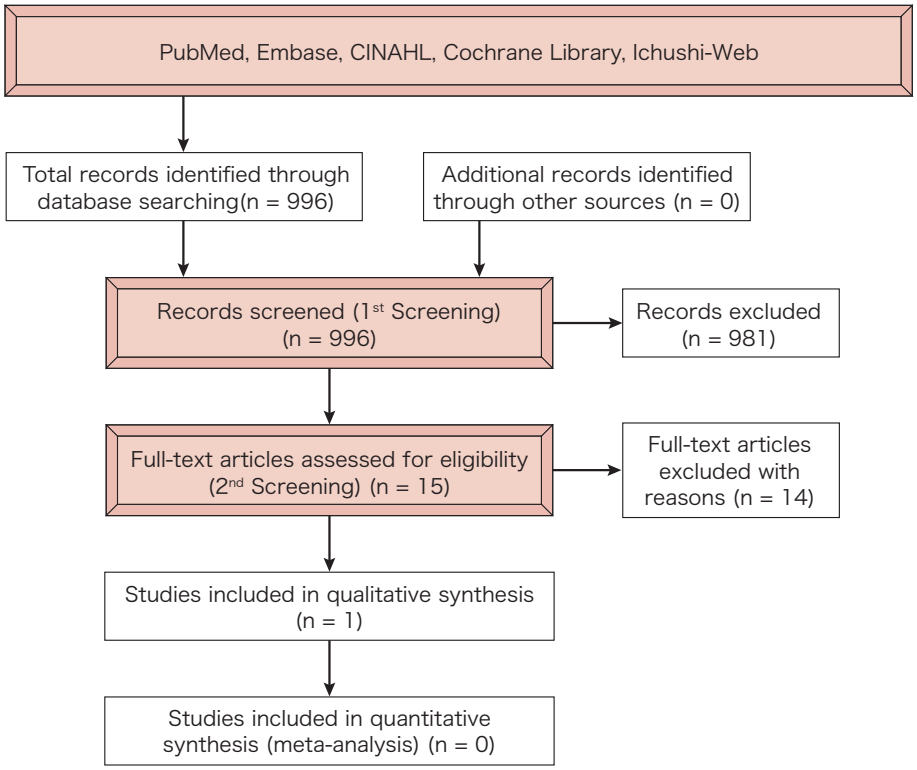

Figure 1: Literature search flowchart

6) List after secondary screening

Table 1: List after secondary screening

Literature	Design	P	I	C	O	Exclusion	Comment
Field, 2018	Randomized controlled trial	Acute stroke patients	Addition of reflex cough assessment by inhalation citric acid induction test	Conduct physical assessment	Aspiration pneumonia outbreak		

7) List of included papers

Table 2: List of included papers

Included papers	Field M, Wenke R, Sabet A, et al.	Implementing cough reflex testing in a clinical pathway for acute stroke. a pragmatic randomised controlled trial. Dysphagia 2018; 33(6): 827-839.

8) Qualitative systematic review

Table 3: Qualitative systematic review

CQ	2	Is it advisable to manage oropharyngeal dysphagia based on a systematic assessment using physical assessment techniques (interview, visual inspection, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia? To avoid duplication with CQs 3, 4, 5, and 6, assessments using only Repetitive Saliva Swallowing Test (RSST), Modified Water Swallowing Test (MWST), Food Test (FT), or cervical auscultation were not included here.
P		Persons aged 18 years and older with suspected dysphagia
I		Management of oropharyngeal dysphagia based on physical assessment techniques
C		Management of oropharyngeal dysphagia through observation of conventional methods
Clinical context		Physical assessment techniques are based on the integration of subjective and objective information. The subjective information is obtained from the medical history of the patient and family members, the medical history of the preceding, preparation, oral, pharyngeal, and esophageal phases, and the medical history of the general condition, including respiration and nutritional status. Based on the results of the interview, objective information is obtained from the physical examination of the brain and nervous system (mainly olfactory, optic, trigeminal, facial, glossopharyngeal, vagus, accessory, and hypoglossal nerves), respiratory system, nutritional status related to eating and swallowing, facial appearance, speech, lips, temporomandibular joint, oral cavity, tongue, soft palate, anterior palatine arch, and oral sensation. Physical examination of the larynx, trachea, lungs, and general condition should be performed by visual, palpation, auscultation, and percussion techniques. Physical assessment techniques are often performed prior to screening tests, such as RSST, MWST, FT, cough test, etc. Physical examinations of the cerebral nervous system, respiratory system, etc. can be used to assess the eating and swallowing function of convalescents with impaired consciousness and cognitive impairment. The results of physical assessment techniques can be used to assess the eating and swallowing functions of patients with impaired consciousness and cognitive impairment. The results of physical assessment techniques are then used to select an appropriate management technique for oropharyngeal dysphagia.
O1		Occurrence of aspiration pneumonia
Summary of indirectness		It was judged to be "low (0)."
The risk of bias summary		The intervention was not blinded to patients or medical personnel, and the risk of bias was set at "moderate/suspected (-1)."
Inconsistency and other summary		The risk of imprecision was judged to be "moderate/suspected (-1)" due to the small sample size and number of events.
Comment		The physical examination technique was not an intervention, but rather a standard of care for the control group. The physical assessment techniques used in the control group consisted of a history and oral motor assessment by a speech-language pathologist, followed by a bedside oral and pharyngeal swallowing assessment. This was followed by an oral intake trial based on physical assessment techniques, and, if necessary, a referral for swallowing angiography. The incidence of pneumonia within 3 months was 1% in the intervention group and 3.2% in the control group, with a relative risk of 0.32 (95% CI: 0.06–1.62). There was no significant difference in the incidence of pneumonia between the intervention and control groups.

References

1. Kamakura, Y., ed. Dysphagia Nursing from Physical Assessment to Swallowing Training. Igakushoin, Tokyo 2000. (in Japanese)
2. Field M, Wenke R, Sabet A, et al. Implementing cough reflex testing in a clinical pathway for acute stroke. a pragmatic randomised controlled trial. Dysphagia 2018; **33**(6): 827-839.
3. Mann G. MASA: The Mann assessment of swallowing ability, Thomson Learning, NY, 2002.

3. CQ 3, CQ 4, CQ 5

1) Recommendations for each CQ

CQ 3

Is it advisable to screen for aspiration by Repetitive Saliva Swallowing Test (RSST) in persons over 18 years of age suspected of having dysphagia?

Recommendations

○ We suggest that individuals aged 18 years and older, who are suspected of having dysphagia, should be screened for aspiration using Repetitive Saliva Swallowing Test (RSST).

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] Repetitive Saliva Swallowing Test (RSST) requires movement with an understanding of instructions, and caution should be exercised regarding its application to persons with impaired consciousness or severe cognitive impairment. Caution should be exercised when applying Repetitive Saliva Swallowing Test (RSST) to patients with xerostomia. Patients with Parkinson's syndrome, who have strong immobility and inactive, are often judged to be abnormal, regardless of their swallowing function.

CQ 4

Is it advisable to screen for aspiration using the Modified Water Swallowing Test (MWST) in persons over 18 years of age, who are suspected of having dysphagia?

Recommendations

○ We suggest screening for aspiration with the MWST in individuals aged 18 years and older, who are suspected of having dysphagia.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] To prevent aspiration of oral bacteria, the mouth should be cleaned before performing the procedure; Modified Water Swallowing Test (MWST) requires movement with an understanding of instructions, and caution should be exercised regarding its application to persons with impaired consciousness or severe cognitive impairment.

CQ 5

Is it advisable to screen for aspiration by FT (Food Test) for persons over 18 years of age, who are suspected of having dysphagia?

Recommendations

○ It is suggested to screen individuals aged 18 years or older suspected of having dysphagia for aspiration using FT (Food Test).

GRADE **2C** (strength of recommendation : **weak**, certainty of evidence (strength) : **weak**)

[Caution] To prevent aspiration of oral bacteria, the mouth should be cleaned before performing the procedure; FT (Food Test) requires movement with an understanding of instructions, and care should be taken regarding its application to persons with impaired consciousness or severe cognitive impairment.

2) Background and purpose

RSST, MWST, and FT are widely used in hospitals, institutions, and homes in Japan to screen for aspiration and pharyngeal residues. These screening tests do not require any special devices and can be easily performed by nurses. In this CQ, we searched for the sensitivity and specificity of these screening tests in adults aged 18 years and older, as well as their effectiveness for those suspected of having dysphagia.

3) Explanation

Cross-sectional observational studies or cohort studies were selected as evidence. In this systematic review, we searched for the screening sensitivity and specificity of the RSST, MWST, and FT for dysphagia. As a result, no articles were extracted that showed the sensitivity and specificity of the combination of RSST, MWST, and FT. Therefore, this CQ will describe the results of a systematic review showing the screening sensitivity and specificity for each test.

Of the three papers used in the systematic review, one was a cross-sectional observational study on the sensitivity and specificity of RSST for detecting aspiration[1)], one was a cross-sectional observational study on the sensitivity and specificity of RSST and MWST for detecting aspiration[2)], and one was a cross-sectional observational study on the sensitivity and specificity of MWST for detecting aspiration and pharyngeal residue, and those of the FT for detecting aspiration[3)]. One was a cross-sectional observational study on the sensitivity and specificity of MWST for detecting aspiration and pharyngeal residue, and one was a cross-sectional observational study on the sensitivity and specificity of the FT for detecting aspiration[3)].

RSST

The sensitivity and specificity for detecting aspiration by RSST were 0.98 and 0.66, respectively, in a study of 131 patients aged 17 years and older[1)] and 0.69 and 0.40, respectively, in a study of 82 patients aged 58 years and older.[2)] A meta-analysis was difficult to conduct because there were only two references. Sensitivity and specificity varied among the articles, and the confidence interval was wide owing to the small number of subjects. We judged that there was no imprecision, and publication bias was unlikely. Overall, the certainty of the evidence was judged to be C (weak).

In addition to the certainty of the evidence, cost, subject intent, the burden on the subject, and feasibility of the assessment method were the main topics of discussion at the panel meeting to determine the recommendation. RSST has the advantages of being painless, costly, and time-saving. Since it does not use food, it is unlikely that the implementation of the test will be significantly different from the intentions of the patient. On the other hand, there are some points that require attention, for example, it may be difficult to implement the

method in patients with strong xerostomia and in post-stroke patients who are unable to perform the indicated movements, and training is necessary when applying the method to elderly patients because errors may occur while judging the swallowing function. In addition, patients with Parkinson's syndrome who have strong immobility and allodynia are often judged as abnormal, regardless of their swallowing function. Although intra-rater reliability was not reported in the literature, Fukada et al. reported r = 0.68, and inter-rater reliability r = 0.95. [4] In addition, caution should be exercised when applying the method to subjects who have difficulty understanding instructions because of cognitive decline, or who have undergone structural changes due to surgery, including changes in the pharynx and larynx. However, it is the safest test method because it does not use drinks or food. Results of the voting indicated that five out of seven members voted for "weak recommendation for implementation" and two members voted for "strong recommendation for implementation," with 71% in favor of "weak recommendation for implementation."

Based on the above, the strength of the recommendation and evidence for this CQ is GRADE 2C (strength of recommendation: weak, certainty of evidence (strength): weak).

MWST

The sensitivity and specificity of MWST for detecting aspiration were 0.71 and 0.43, respectively, in a study of 84 post-stroke patients aged 58 years or older[2], and 0.58 and 0.72, respectively, in a study of 155 stroke patients.[3] The sensitivity and specificity for the detection of pharyngeal residues were 0.43 and 0.64, respectively, in a study of 155 stroke patients.[3] Meta-analysis was difficult to perform because there were only two articles and one article on aspiration and pharyngeal residue, respectively. Sensitivity and specificity varied among the articles, and confidence intervals were wide owing to the small number of subjects. When the outcome was the sensitivity and specificity of aspiration detection, we judged that there was no imprecision, and publication bias was unlikely. When the outcome was the sensitivity and specificity of pharyngeal residue detection, the imprecision was judged to be "severe" and the publication bias was judged to be "none."

Overall, the strength of evidence was judged to be C (weak).

In addition to the certainty of the evidence, the main issues discussed at the panel meeting to determine the recommendation were cost, willingness of the target population, burden on the target population, reliability and feasibility of the assessment methods, and non-directiveness of the studies included in the systematic review. As a reminder, the literature on both aspiration and pharyngeal residue is limited to patients with stroke, except for those with impaired consciousness or severe cognitive impairment, or those with mildly impaired consciousness; MWST requires directed movements and should be applied with caution to recuperate patients with impaired consciousness or severe cognitive impairment. The advantage of MWST is that it can be performed anywhere with water (thickened food) and a syringe at no cost. In hospitals, syringes are not used, to prevent accidents, and catheter tips are sometimes used. Although intra-rater reliability was not reported in the literature, Fukada et al. reported k = 0.88 and inter-rater reliability k = 0.82.[4] Although it is necessary to educate medical personnel in conducting screening tests, the benefits of screening are considered to outweigh the burdens, even considering the costs. In addition, MWST is sometimes used in the calculation of additional oral maintenance (I) (II) in nursing care fees. The default volume of water for MWST is 3 mL, which is safe, but too small, and the patient may have difficulty swallowing. In addition, patients with silent aspiration may be less likely to show symptoms, such as swallowing difficulties.

Water itself is rarely not to the liking of the convalescent, but if a liquid with a thick consistency is used for

safety reasons, it may not be to the liking of the convalescent and may be unacceptable. If the patient can accept the test meal, the burden on the caregiver should be minimal. There are few disadvantages of using the MWST screening test for patients suspected of having dysphagia who can understand the instructions; however, it is considered to be useful.

This CQ reviews MWST, which assesses the swallowing function with small amounts of water. There are various water swallowing tests with different volumes of water, and systematic reviews on their sensitivities and specificities[5] have been reported. There is also an assessment method that combines WST with oxygen saturation[6] and one that controls the amount and viscosity of water.[7]

Results of the voting indicated that five out of seven members voted for "weak recommendation to implement" and 2 members voted for "strong recommendation to implement," with 71% in favor of "weak recommendation to implement."

Based on the above, the strength of the recommendation and evidence for this CQ is GRADE 2C (strength of recommendation: weak; certainty of evidence (strength): weak).

A facilitating factor in the application of the guidelines is that MWST can be performed without the use of special devices. The inhibiting factor is that it requires experience and education to conduct the assessment.

FT

A study of 155 patients with stroke showed a sensitivity of 0.80 and specificity of 0.39 for aspiration detection by FT. [3] A meta-analysis was difficult to conduct because there was only one relevant study; the study included a small number of acute stroke patients from a single institution, and the precision of the results was low. We judged the imprecision to be "serious" and the publication bias to be "none." Based on the above, the overall strength of the evidence was judged to be C (weak).

In addition to the certainty of the evidence, the main issues discussed at the panel meeting for the determination of the recommendation were cost, subject intention, the burden on the subject, reliability and feasibility of the assessment methods, and non-directiveness of the studies included in the systematic review. It should be noted that the literature is based on stroke patients, excluding those with impaired consciousness or severe cognitive impairment, and the use of jelly. FT requires directed movements and should be applied with caution to convalescents with impaired consciousness or severe cognitive impairment. FT screens for function during the oral and pharyngeal phases. It has a high sensitivity for aspiration but low specificity. However, it differs from MWST in that it can determine oral stage impairment (impaired feeding by the tongue) based on oral residues and can predict post-swallowing aspiration due to oral residues. The cost of the test meal (jelly and pudding) should be considered. The test food used may not be to the liking of the patient, but if the patient can accept the test food, the burden on the patient should be minimal. It should be noted that there is a high risk of aspiration and choking because the test is performed using food. Intra-rater reliability was not reported in the literature, but Fukada et al. reported k = 0.87 and inter-rater reliability k = 0.84. [4] Although it can be performed anywhere with a test meal and a spoon, and education of medical personnel is necessary, the benefits of screening outweigh the costs. In summary, there are few disadvantages to using FT to screen for people having dysphagia; however, it is considered to be useful.

Results of the voting indicated that five of seven members voted for "weak recommendation to implement" and two members voted for "strong recommendation to implement," with 71% in favor of "weak recommendation to implement."

Based on the above, the strength of the recommendation and evidence for this CQ is GRADE 2C (strength of recommendation: weak; certainty of evidence (strength): weak).

4) Database search results

Modified Water Swallow Test, Modified Water Swallowing Test, MWST, Repetitive Saliva Swallow Test, Repetitive Saliva Swallowing Test, RSST, screening. aspiration pneumonia, cough-test, deglutition disorder, deglutition disorders, dysphagia, pharynx, food-test, function-test, modified water swallow test, modified water swallowing test, MWST, oropharynx, aspirate, pneumonia, aspiration, repetitive saliva swallow test, residue, repetitive saliva swallowing test, RSST, screening-test, (swallowing function, dysphagia, dysphagia, swallowing pneumonia, revised water swallow, revised water swallow, intra-airway aspiration, aspirate pneumonia, aspiration, aspiration pneumonia, residue, cough test, screening Pneumonia-Swallowing, Repeated Saliva, Food Test [in Japanese]), were used as keywords. The databases included PubMed (until August 31, 2019), Embase (until August 31, 2019), CINAHL (until August 31, 2019), Cochrane Library (until August 31, 2019), and Ichushi-Web (until August 31, 2019). As a result, 362 studies were identified and three observational studies were adopted after screening. The database search formulae are included in the Appendix.

5) Literature search flowchart

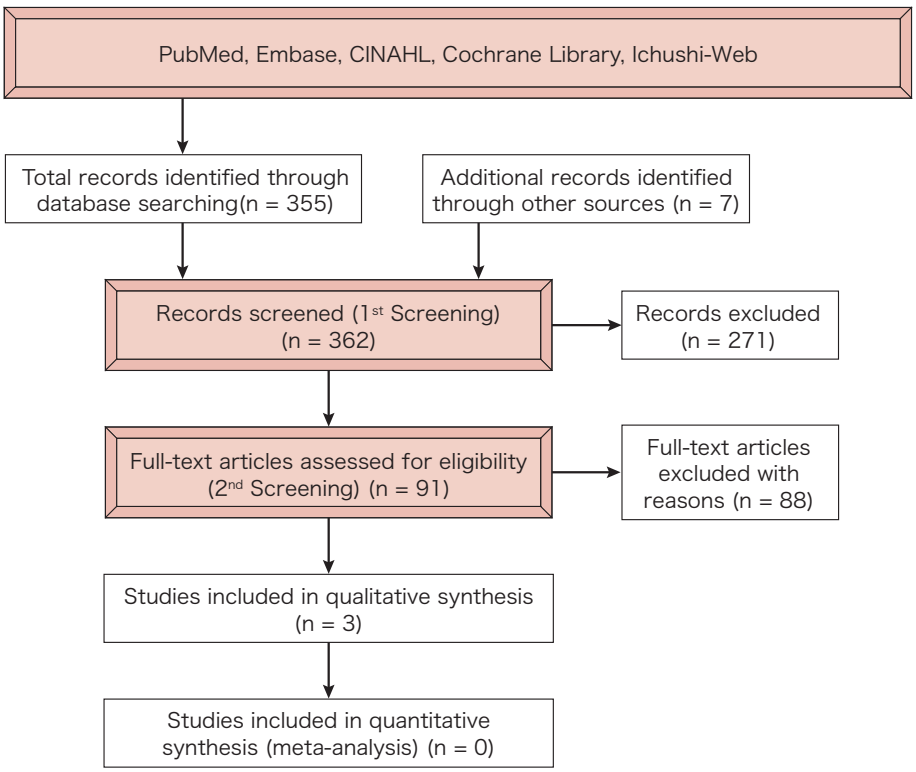

Figure 1: Literature search flowchart

6) List after secondary screening

Table 1: List after secondary screening

Literature	Design	P	Index test	Reference standard	O	Exclusion	Comment
Oguchi, 2000	Cross-sectional study	Patients with functional dysphagia	RSST	VF	Sensitivity and specificity of aspiration and subclinical aspiration detection		
Watanabe, 2007	Cross-sectional study	Stroke patients	RSST, MWST	VF	Sensitivity and specificity of aspiration detection		
Osawa, 2012	Cross-sectional study	Stroke patients	MWST, FT	VF	Sensitivity and specificity of aspiration detection		

7) List of included papers

Table 2: List of included papers

Included papers	Oguchi K, Saitoh E, Baba M, et al.	A review of the Repetitive Saliva Swallowing Test (RSST), a screening test for functional dysphagia (2) A review of validity. Rehab Med 2000; 37(6):383-388.
Included papers	Watanabe S.	Factors associated with aspiration after stroke. Journal of Aichi Gakuin University Dental Society 2007; 45(4):579-590.
Included papers	Osawa A, Maejima S, Tanahashi N.	Food Swallowing and Liquid Swallowing in Stroke Patients: Clinical Findings Using the Food Test and the Modified Water Swallowing Test and a Study of Swallowing Contrastography. Jpn J Rehab Med 2012;49(11):838-845.

8) Qualitative systematic review

Table 3: CQ3 qualitative systematic review

CQ	3	Is it advisable to screen for aspiration by Repetitive Saliva Swallowing Test (RSST) in persons over 18 years of age suspected of having dysphagia?
P		Persons over 18 years of age with suspected dysphagia
Index test		RSST
Reference standard		VE or VF
Clinical context		A screening test for aspiration and pharyngeal residue that is widely used in hospitals, institutions, and homes in Japan is the RSST. This test is performed in a sitting position with the neck slightly bent forward. During a 30-s period, the number of times the laryngeal ridge moves upward and forward over the third finger during the swallowing motion is counted. If the number of swallows is less than 3, the patient is at risk for dysphagia.
O1		True positives, true negatives, false positives, and false negatives in aspiration detection
Summary of indirectness		Decided "none."
The risk of bias summary		It was judged as "unlikely" because there are reports on whether the examiners were blinded or did not state if they were blinded to the index tests and reference standards.
Inconsistency and other summary		Inconsistency was judged to be "unlikely" because sensitivity and specificity varied among the papers, and imprecision was judged to be "unlikely" because the confidence interval was wide due to the small number of subjects.
Comment		The sensitivity and specificity of RSST (Repetitive Saliva Swallowing Test) for aspiration detection was 0.98 and 0.66, respectively, in a study of 131 patients aged 17 years and older[1] and 0.69 and 0.40, respectively, in a study of 82 patients aged 58 years and older.[2]

Table 4: CQ4 qualitative systematic review

CQ	4	Is it advisable to screen for aspiration using the Modified Water Swallowing Test (MWST) in persons over 18 years of age, who are suspected of having dysphagia?
P		Persons aged 18 years and older with suspected dysphagia
Index test		MWST
Reference standard		VE or VF
Clinical context		A screening test for aspiration and pharyngeal residue that is widely used in hospitals, institutions, and homes in Japan is the MWST. The evaluation method is as follows. Pour 3 ml of cold water into the floor of the mouth with a disposable syringe and instruct the patient to swallow. If the patient is unable to swallow or if subclinical aspiration is suspected, the procedure is terminated immediately. If the patient swallows and breathes properly, check if there is wet hoarseness in "a-." If there is choking or wet hoarseness, terminate the test immediately and rate the patient's condition at 3 points. If there is no choking or wet hoarseness, signal "swallow" and instruct the patient to swallow twice; if the patient can swallow twice within 30 seconds, rate the patient at 5 points; if not, rate the patient at 4 points. To ascertain the voice quality before swallowing the cold water, the patient vocalized before the procedure. If the evaluation score was 4 or more, two trials were conducted; the worst of the two values was considered the grade. It is important to maintain the oral environment, especially in areas under the control of the glossopharyngeal and vagus nerves before conducting the test. In addition to MWST, there are various other methods that vary the amount of water to be consumed. In general, the WST increases the amount of water in stages and assesses whether the patient can swallow without aspiration. In addition, tongue movement is also observed to assess the tongue movement leading to chewing, for example, whether the tongue comes out when water is placed on the upper lip.
O1		True positives, true negatives, false positives, and false negatives in aspiration detection
Summary of indirectness		Decided "none."
The risk of bias summary		The risk of bias was judged to be "unlikely" because there were reports that did not describe the index tests and reference standards.
Inconsistency and other summary		We judged inconsistency to be "unlikely" because there were variations in sensitivity and specificity values reported in the papers.
Comment		The sensitivity and specificity of the MWST for aspiration detection were 0.71 and 0.43, respectively, in a study of 84 post-stroke patients aged 58 years and older, and 0.58 and 0.72, respectively, in a study of 155 stroke patients.

Table 5: CQ5 qualitative systematic review

CQ	5	Is it advisable to screen for aspiration by FT (Food Test) for persons over 18 years of age, who are suspected of having dysphagia?
P		Persons aged 18 years and older with suspected dysphagia
Index test		FT
Reference standard		VE or VF
Clinical context		One screening test for aspiration and pharyngeal residue that is widely used in hospitals, institutions, and homes in Japan is the FT. The evaluation method is as follows. Using a teaspoon, place approximately 4 g of swallowing jelly on the dorsal anterior surface of the tongue and instruct the patient to swallow. The method of conducting and judging the test is similar to that of MWST, with the difference that oral residues after swallowing are the subject of evaluation. A score of 3 is given if there is moderate oral residue after swallowing, and a score of 4 or higher is given if the patient can swallow without swallowing and there are no oral residues. If the score is 4 or higher, two trials are conducted and the worst of the two values is used as the grade. For FT, it is also important to keep the oral environment clean, especially the areas controlled by the glossopharyngeal and vagus nerves, before conducting the test.
O1		True positives, true negatives, false positives, and false negatives in aspiration detection
Summary of indirectness		Decided "none."
The risk of bias summary		Decided "none."
Inconsistency and other summary		Since there was only one paper, it was judged to be "serious" in terms of imprecision.
Comment		A study of 155 stroke patients showed a sensitivity of 0.80 and specificity of 0.39. The relevant literature is a study of a small number of acute stroke patients at a single institution, and the precision of the results is low.

References

1. Oguchi K, Saitoh E, Baba M, et al. The Repetitive Saliva Swallowing Test (RSST) as a screening test of functional dysphagia (2) validity of RSST. Jpn J Rehabil Med 2000;**37**(6):383-388. (in Japanese)
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7. Clave P, Arreola V, Romea M, et al. Accuracy of the volume-viscosity swallow test for clinical screening of oropharyngeal dysphagia and aspiration. Clin Nutr 2008; **27**(6): 806-815.

4. CQ 6

CQ 6

Is it advisable to screen for aspiration and pharyngeal residues by cervical auscultation in persons aged 18 years or older, who are suspected of having dysphagia?

1) Recommendations

○Screening for aspiration and pharyngeal residues swallowing by cervical auscultation should be performed in individuals aged 18 years and older, who are suspected of having dysphagia.

GRADE **2C** (strength of recommendation : **weak**, certainty of evidence (strength) : **weak**)

[Caution] Education on screening for aspiration and pharyngeal residues is needed for nurses who perform cervical auscultation.

2) Background and purpose

RSST, MWST, FT, and cervical auscultation are used in hospitals and homes as screening tests for aspiration and pharyngeal residues swallowing in individuals aged 18 years or older who are suspected of having dysphagia. Cervical auscultation is a physical assessment method in which a stethoscope is used to listen to breathing (tracheal sounds) before and after swallowing on the right and left sides of the neck (the skin just below the cricoid cartilage on the outer side of the trachea) to determine whether there is aspiration or residual pharyngeal sounds. This method is less burdensome for the patient and can be performed on patients with cognitive decline who are unable to follow instructions.

The sounds that can be auscultated at the neck are swallowing sounds produced in the pharynx during swallowing of food boluses and breath sounds produced before and after swallowing. The nature and length of the swallowing sounds and the nature and timing of breath sounds are used to determine dysphagia, primarily in the pharyngeal region of the patient. It is very important to ensure that the patient has a clear breath sound before swallowing and to compare this sound with the breath sounds after swallowing. In a normal patient, a clear breath sound can be heard before swallowing, followed by a respiratory pause with swallowing, a swallowing sound, and a clear breath sound after swallowing. On the other hand, aspiration should be suspected if swallowing sounds, such as sputum with swallowing, or bubbling sounds are heard during swallowing, or if wet sounds, sputum with swallowing, or wheezing-like breath sounds are heard immediately after swallowing. If respiratory sounds, such as rinsing or vibrating liquids, are heard immediately after swallowing, pharyngeal retention should be suspected.

A systematic review of the sensitivity and specificity of cervical auscultation was conducted by Lagarde et al.[1], which is also presented in "Assessment of Dysphagia 2019" by the Medical Review Committee of the Japanese Society of Dysphagia Rehabilitation. Six references were extracted, but they included articles on sensitivity and specificity evaluated using questionnaires and oral function tests that evaluate cervical auscultation, sensitivity and specificity determined using the presence or absence of dysphagia as the reference standard for cervical auscultation, and articles that were not limited to sensitivity and specificity for detecting aspiration and pharyngeal

residues.

We examined whether performing cervical auscultation in individuals aged 18 years or older suspected of having dysphagia contributes to improved outcomes for caregivers and the sensitivity and specificity of detecting aspiration and pharyngeal residues from domestic and international literature. The reference standard for checking sensitivity and specificity was VF or VE.

3) Explanation

Cross-sectional observational studies or cohort studies were selected. Thirteen articles were used for the systematic review.[2)-14)]

Sensitivity and specificity were determined from 10 articles describing screening for aspiration based on the results of respiratory and swallowing sounds obtained by cervical auscultation; for studies showing more than one result, the best value was used for meta-analysis. The sensitivity was 0.83 (95% CI: 0.72–0.91), which indicates the proportion of those suspected of aspiration by cervical auscultation to those diagnosed with aspiration by VF/VE (the reference standard). Conversely, the combined specificity, which indicates the proportion of those diagnosed as not having aspiration by cervical auscultation against those diagnosed as not having aspiration by VF/VE, was 0.79 (95% CI: 0.67–0.88). Both sensitivity and specificity are approximately 0.8; therefore, the sensitivity and specificity of screening were high.

The results of a meta-analysis of the sensitivity and specificity of screening for aspiration based on observations of respiratory and swallowing sounds by cervical auscultation showed that the sensitivity was 0.78 (95% CI: 0.56–0.91) and 0.70 (95% CI: 0.53–0.83), respectively, and the specificity was 0.65 (95% CI: 0.67–0.88) and 0.85 (95% CI: 0.54–0.97), respectively. A meta-analysis of the sensitivity and specificity of screening for aspiration was not possible using cervical auscultation observations of both breath and swallow sounds because the number of publications was small. Although the sensitivity of both breath and swallow sounds was greater than 0.70, the specificity of breath sounds was less than 0.70, and the sensitivity and specificity were not high based on the 95% CIs for both.

We will take a closer look at the sensitivity and specificity of screening for aspiration by cervical auscultation for (1) breath sounds, (2) swallow sounds, and (3) breath and swallowing sounds. Shaw et al.[2)] performed cervical auscultation during the swallowing of water, yogurt, etc., and VF within 1 h of swallowing in 105 patients aged 17–96 years and found that the prevalence of aspiration was 38%, and the sensitivity of cervical auscultation in detecting aspiration was low, at 0.45 (95% CI: 0.29–0.62) and the specificity was high, at 0.88 (95% CI: 0.77–0.95). The sensitivities and specificities for detecting aspiration by food type were 0.38 (95% CI: 0.24–0.54) and 0.90 (95% CI: 0.80–0.95) for water, respectively, and 0.33 (95% CI: 0.14–0.61), 0.93 (95% CI: 0.85–0.97) for yogurt. The sensitivity was low but the specificity was high. Similarly, Nozue et al.[3)] performed cervical auscultation during VF with yogurt-containing barium in 46 patients aged 39-89 years. The prevalence of aspiration was 35%, and the sensitivity and specificity of cervical auscultation in detecting aspiration were low, at 0.58 (95% CI: 0.50–0.65) and 0.54 (95% CI: 0.49–0.59), respectively. On the other hand, Inoue et al.[4), 5)] examined sensitivity and specificity in 105 patients, mainly in their 70s and 80s, who aspirated after VF with jelly, a yogurt-alike, or liquid barium, using cervical auscultation as a positive test if there were changes in breath sounds before and after swallowing. The risk of selection bias was high, with a sensitivity of 0.93 (95% CI: 0.83–0.98) and specificity of 0.79 (95% CI: 0.63–0.90). Watanabe et al.[6), 7)] performed cervical auscultation while swallowing 3 mL of water on the same day as VF in 90 postoperative patients with oral cancer aged 64.5 ±

12.8 years, and found that the prevalence of aspiration was 37% and the sensitivity of detection was 0.91% (95% CI: 0.76–0.98) and specificity was 0.86 (95% CI: 0.74–0.94). In a study by Sugimoto et al.[8] with a small sample size, cervical auscultation was performed on 16 patients aged 13–91 years during VF using barium in jelly and liquid form. The results showed that both sensitivity and specificity were high, at 0.80 (95% CI: 0.44–0.97) and 1.00 (95% CI:0.54–1.00), respectively.

Next, five articles determined aspiration by observing swallowing sounds using cervical auscultation. In the aforementioned study by Watanabe et al.[6), 7)] the sensitivity was low, at 0.55 (95% CI: 0.36–0.72), and the specificity was high, at 0.96 (95% CI: 0.88–1.00). Conversely, in the study by Nozue et al.[3)], the sensitivity was high, at 0.72 (95% CI: 0.65–0.79) and specificity was low, at 0.50 (95% CI: 0.44–0.55). Similarly, in a study by Stroud et al.[9)], 16 patients aged 29–65 years underwent cervical auscultation during VF. The prevalence of aspiration was 19%, with a high sensitivity of detection of 0.93 (95% CI: 0.78–0.99) and low specificity of 0.56 (95% CI: 0.47–0.65). In one of the two studies with a high risk of selection bias and small sample size, Leslie et al.[10)] performed VF and cervical auscultation using a yogurt-alike and liquid barium in 10 healthy subjects aged 24–78 years and 10 stroke patients aged 65–90 years. The sensitivity was 0.80 (95% CI: 0.44–0.97) and specificity was 0.90 (95% CI: 0.55–1.00). On the other hand, Santamato et al.[11)] performed VE with 10 mL of water and cervical auscultation on 15 patients with dysphagia in the age group of 56–80 years, and found that the prevalence of aspiration and penetration was 53%, but the sensitivity of detection was low, at 0.50 (95% CI: 0.16–0.84) and specificity was high, at 1.00 (95% CI: 0.59–1.00). In studies that determined aspiration by observing swallowing sounds, there was a trade-off between sensitivity and specificity.

Three studies determined aspiration by both swallow and breath sounds using cervical auscultation. In the aforementioned study by Nozue et al.[3)], the sensitivity was high 0.82 (95% CI: 0.76–0.87) and the specificity was low 0.47 (95% CI: 0.42–0.52). Caviedes et al.[12)] performed cervical auscultation with VE while swallowing jelly in 63 patients aged 70 ± 17 years with cerebrovascular disease admitted to the ICU, and found that the prevalence of aspiration was 27%, with the sensitivity of detection of 0.82 (95% CI: 0.57–0.96) and specificity of 0.80 (95% CI: 0.66–0.91); both values were high. In a study by Borr et al.[13)] with a high risk of selection bias, 14 dysphagic patients with aspiration and penetration aged 44–89 years, 25 young and 25 elderly patients were subjected to neck auscultation during VF while swallowing 10 mL water. The sensitivity was 0.94 (95% CI: 0.88–0.98) and specificity was 0.70 (95% CI: 0.63–0.77); both values were high.

The sensitivity and specificity of screening for aspiration using cervical auscultation tended to be higher when using results from both swallowing and breath sounds, and the sensitivity and specificity of detecting aspiration using only breath or swallow sounds were not high. Inaccuracy was judged as "none" and publication bias as "unlikely" The overall strength of evidence, including intra-rater and inter-rater reliability, was judged to be C (weak).

One study determined pharyngeal residue after swallowing by breath sounds using neck auscultation. In the study by Tamura et al.[14)], the sample size was small, and they performed cervical auscultation during VF and while swallowing barium jelly in 8 patients aged 78.4 ± 12.8 years requiring nursing care with dysphagia due to sequelae of cerebrovascular disease. The prevalence of residual pharyngeal sounds was 63%, with a sensitivity of 0.60 (95% CI: 0.15–0.95) and specificity of 0.67 (95% CI: 0.09–0.99); both the values were low. Imprecision was judged as "serious" and publication bias as "none" Therefore, we judged the strength of the evidence to be D (very weak).

During the panel meeting to determine the recommendation, in addition to the certainty of the evidence, the

main issues discussed were cost, subject intention, the burden on the subject, reliability and feasibility of the assessment method, and indirectness of the studies included in the systematic review. We would like to recommend cervical auscultation as a screening method because it can be performed as a part of the physical assessment with little time and cost, and if the risk of aspiration and pharyngeal residue is detected at an early stage, the benefit to the caregiver is great. However, education is necessary to accurately determine the respiratory and swallowing sounds that indicate aspiration. In the study by Nozue[3], the Kappa coefficients for intra-rater reliability of respiratory sounds, swallowing sounds, and both were 0.47 (moderate), 0.64 (good), and 0.60 (good), respectively. In the study by Leslie et al.[10], the Kappa coefficient for intra-rater reliability of swallowing sounds was 0.35 (fair, on average), while the kappa coefficient for inter-rater reliability was much lower at 0.17 (poor). Similarly, in the study by Stroud et al.[9], the Kappa coefficient for intra-rater reliability of cervical auscultation was 0.55 (moderate), while the kappa coefficient for inter-rater reliability was low, at 0.28 (fair). These suggest the need for education on cervical auscultation assessment. Because the cervical auscultation method is not limited by the type of liquid or food, it is unlikely that its implementation would be significantly different from the intentions of the caregivers. Results of the voting indicated that 8 out of 9 participants voted for "weak recommendation to perform" and 1 voted for "strong recommendation to perform," with 89% in favor of "weak recommendation to perform."

Based on the above, the strength of the recommendation and evidence for this CQ is GRADE 2C (strength of recommendation: weak, certainty of evidence (strength): weak).

The facilitating factor in the application of this medical guideline is that the cervical auscultation method can be performed with a stethoscope and by nurses. The inhibiting factor is that it requires experience and education to conduct the assessment.

4) Database search results

Aspiration pneumonia, aspiration, auscultation, cervical, deglutition disorder, dysphagia pharynx, oropharynx, pneumonia, residue, stethoscopes, swallowing sound, (swallowing, dysphagia, dysphagia, aspiration, aspiration pneumonia, intraglottic aspiration, aspiration pneumonia, residual, screening, auscultation, pneumonia, evaluation [in Japanese]) were used as keywords. The databases included PubMed (until August 31, 2019), Embase (until August 31, 2019), CINAHL (until August 31, 2019), Cochrane Library (until August 31, 2019), and Ichushi-Web (until August 31, 2019). A total of 336 studies were identified, and 13 observational studies were recruited after screening. The database search formulae are included in the appendix.

5) Literature search flowchart

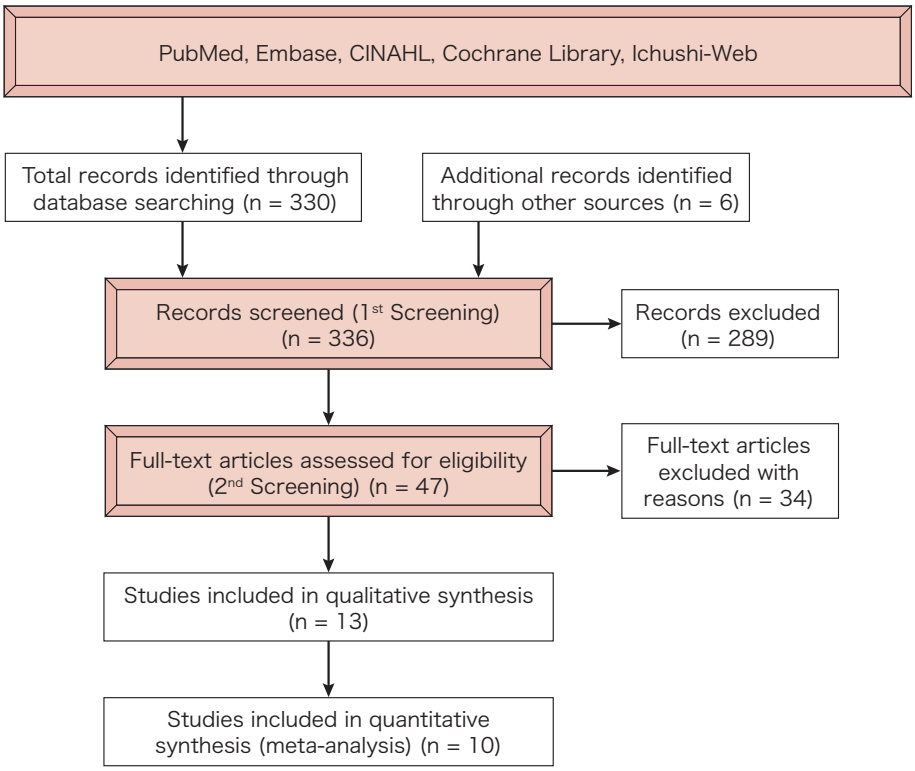

Figure 1: Literature search flowchart

6) List after secondary screening

Table 1: List after secondary screening

Literature	Design	P	Index test	Reference standard	O	Exclusion	Comment
Shaw, 2004	Cross-sectional study	Adults who underwent VF testing	Bronchial auscultation by PT and observation of clinical signs of aspiration by SLPs	VF	Sensitivity and specificity of aspiration and aspiration risk detection		
Inoue, 2007	Cross-sectional study	Adults who underwent VF testing	Cervical auscultation	VF	Sensitivity and specificity of aspiration detection		
Inoue, 2005	Cross-sectional study	The average age of patients who underwent VF examination was 72.2 years	Confirmation of changes in breath sounds by cervical auscultation	VF	Sensitivity and specificity of aspiration detection		
Sugimoto, 2010	Cross-sectional study	Patients (13–91 years) who underwent VF examination	Cervical auscultation	VF	Sensitivity and specificity of aspiration detection		
Caviedes, 2010	Prospective observational study	ICU patients (average age: 70 years)	Cervical auscultation (and other methods)	V-E	Sensitivity and specificity of aspiration detection		
Watanabe, 2006	Cross-sectional study	Postoperative patients with oral cancer who underwent VF examination and screening tests	Cervical auscultation, RSST, MWST	VF	Sensitivity and specificity of aspiration detection		
Ohshige, 2012	Cross-sectional study	Postoperative oral cancer patients	Cervical auscultation	VF	Sensitivity and specificity of aspiration detection		
Borr, 2007	Cross-sectional study	Patients with dysphagia (mean age: 71 years) and healthy subjects (25–44 years, 60–97 years)	Analysis of sound waveforms obtained from cervical auscultation	VF	Sensitivity and specificity of aspiration and penetration detection		
Leslie, 2004	Cross-sectional study	Healthy volunteers (24–78 years) and stroke patients (65–90 years)	Cervical auscultation	VF	Agreement of aspiration and penetration detection results among raters		
Santamato, 2009	Cross-sectional study	Patients with dysphagia (mean age: 73.1 years)	Analysis of sound obtained from microphones	VE	Sensitivity and specificity of detection of aspiration and penetration		
Stroud, 2002	Cross-sectional study	Patients with dysphagia (29–65 years)	Cervical auscultation	VF	Agreement in aspiration detection results between raters		
Nozue, 2017	Cross-sectional study	Dysphagic patients aged 39–89 years	Cervical auscultation	VF	Sensitivity and specificity of detection of aspiration and penetration		
Tamura, 2008	Cross-sectional study	Dysphagia due to sequelae of cerebrovascular disease	Food observation and cervical auscultation	VF	Residual laryngeal trough and pyriform fossa after swallowing		

7) List of included papers

Table 2: List of included papers

Included papers	Shaw JL, Sharpe S, Dyson SE, et al.	Bronchial auscultation: an effective adjunct to speech and language therapy bedside assessment when detecting dysphagia and aspiration? Dysphagia 2004; 19(4):211-218.
Included papers	Inoue T, Suzuki N.	Physical evaluation during aspiration: Correlation between the results of swallowing angiography, neck auscultation, and breath sound auscultation. J Jpn Soc Res Care Rehab 2007; 17(1):50-56.
Included papers	Inoue T, Suzuki N, Deguchi H, et al.	Efficacy of respiratory and cervical auscultation sound assessment during small volume aspiration. J Jpn Soc Food Swallow Rehab 2005; 9: 413-414.
Included papers	Sugimoto M, Hara Y, Inaba M, et al.	Determination of aspiration with cervical auscultation and swallowing angiography. Intravenous enteral nutrition 2010; 25(1):1269.
Included papers	Caviedes IR, Lavados PM, Hoppe AJ, et al.	Nasolaryngoscopic validation of a set of clinical predictors of aspiration in a critical care setting. J Bronchology Interv Pulmonol 2010;17(1):33-38.
Included papers	Watanabe S, Ohshige H, Miyachi H, et al.	Screening tests for dysphagia in postoperative oral cancer patients. Tokeibu Gan 2006; 32(1):34-39.
Included papers	Borr C, Hielscher-Fastabend M, Lücking A.	Reliability and validity of cervical auscultation. Dysphagia 2007; 22(3):225-234.
Included papers	Leslie P, Drinnan MJ, Finn P, et al.	Reliability and validity of cervical auscultation: A controlled comparison using videofluoroscopy. Dysphagia 2004; 9(4):231-240.
Included papers	Santamato A , Panza F, Solfrizzi V, et al.	Acoustic analysis of swallowing sounds: A new technique for assessing dysphagia. J Rehabil Med 2009; 41(8):639-645.
Included papers	Stroud AE, Lawrie BW, Wiles CM.	Inter-and intra-rater reliability of cervical auscultation to detect aspiration in patients with dysphagia. Clin Rehabil 2002; 16(6):640-645.
Included papers	Nozue S, Ihara Y, Takahashi K, Harada Y, Takei Y, Yuasa K, Yokoyama K.	Accuracy of cervical auscultation in detecting the presence of material in the airway. Clin Exp Dent Res 2017; 3(6):209-214.
Included papers	Tamura F, Kikutani T, Suda M, et al.	Relationship between dietary observation evaluation and VF test evaluation of eating and swallowing function in persons requiring nursing care. Geriatric Denti 2008; 23(1):50-55.

8) Qualitative systematic review

Table 3: Qualitative systematic review

CQ	6	Is it advisable to screen for aspiration and pharyngeal residues by cervical auscultation in persons aged 18 years or older, who are suspected of having dysphagia?
P		Persons over 18 years of age with a suspected dysphagia
I		Cervical auscultation
C		VF or VE
Clinical context		In Japan, RSST (Repetitive Saliva Swallowing Test), MWST (Modified Water Swallowing Test), FT (Food Test), and cervical auscultation are used as screening tests for aspiration and pharyngeal residues in hospitals and homes. Among these, cervical auscultation is a physical assessment method in which a stethoscope is used to listen to the breathing (tracheal sounds) before and after swallowing on the right and left sides of the neck (the skin just below the cricoid cartilage on the outer side of the trachea) to determine if there is aspiration or residual pharyngeal sounds. This method is less burdensome for the patient and can be performed on patients with cognitive decline who are unable to follow instructions. The sounds that can be auscultated at the neck are the swallowing sounds produced in the pharynx during the swallowing of food and the breathing sounds before and after swallowing. The nature and length of the swallow sounds and the nature and timing of the breath sounds are used to determine dysphagia, primarily in the pharyngeal region of the patient. It is very important to make sure that the patient has a clear breath sound before swallowing and compare this sound with the breath sound after swallowing. In a normal patient, a clear breath sound can be heard before swallowing, followed by a respiratory pause with swallowing, a swallowing sound, and a clear breath sound after swallowing. On the other hand, aspiration should be suspected if swallowing sounds, such as sputum with swallowing, and bubbling sounds are heard during swallowing, or if wet sounds, sputum with swallowing, and wheezing-like breath sounds are heard immediately after swallowing. If respiratory sounds, such as rinsing or vibrating liquid, are heard immediately after swallowing, pharyngeal retention should be suspected.
O1		True positives, true negatives, false positives, and false negatives in aspiration detection
Summary of indirectness		Studies that included healthy subjects were also included, and indirectness was "unlikely."
The risk of bias summary		The risk of bias was "unlikely" because the examiners may not have been blinded or we were unsure if they were blinded from the index test or reference standard results.
Inconsistency and other summary		Sensitivity and specificity varied, and inconsistency was "unlikely."
Comment		The sensitivity and specificity of screening for aspiration using cervical auscultation tend to be higher when the results of both swallowing and breath sounds are used, but the sensitivity and specificity are not as high when aspiration is detected using only breath sounds or only swallowing sounds.
O2		Sensitivity and specificity of detection of the pharyngeal residues (true positive, true negative, false positive, false negative)
Summary of indirectness		Decided "none."
The risk of bias summary		Based on the results of the reference standard test for the index examiners, it was not stated whether they were blinded or not, and "unlikely" was selected.
Inconsistency and other summary		The imprecision was judged to be "serious" because there was only one paper.

9) Meta-analysis

We performed a meta-analysis of 10 articles describing screening for aspiration based on the results of breath sounds, swallow sounds, and breath and swallow sounds by cervical auscultation. For studies showing more than one result, the best value was used for the meta-analysis. The sensitivity of those suspected of having aspiration by cervical auscultation against the proportion of those diagnosed with aspiration by VF/VE as the reference standard was 0.83 (95% CI: 0.72–0.91). Conversely, the combined specificity, which indicates the proportion of those diagnosed as not having aspiration by cervical auscultation to those diagnosed as having aspiration by VF/VE, was 0.79 (95% CI: 0.67–0.88) (**Figure 2**).

A meta-analysis of the sensitivity and specificity of screening for aspiration based on the results of respiratory and swallowing sounds using cervical auscultation showed that the sensitivity was 0.78 (95% CI: 0.56–0.91) and 0.70 (95% CI: 0.53–0.83), respectively, and the specificity was 0.65 (95% CI: 0.67–0.88) and 0.85 (95% CI: 0.54–0.97), respectively (**Figures 3 and 4**).

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Borr 2007	110	54	7	126	0.94 [0.88, 0.98]	0.70 [0.63, 0.77]
Caviedes 2010	14	9	3	37	0.82 [0.57, 0.96]	0.80 [0.66, 0.91]
Inoue 2005, 2007	62	8	5	30	0.93 [0.83, 0.98]	0.79 [0.63, 0.90]
Leslie 2004	8	1	2	9	0.80 [0.44, 0.97]	0.90 [0.55, 1.00]
Nozue ES+SS 2017	157	191	35	169	0.82 [0.76, 0.87]	0.47 [0.42, 0.52]
Santamato 2009	4	0	4	7	0.50 [0.16, 0.84]	1.00 [0.59, 1.00]
Shaw 2004	18	8	22	57	0.45 [0.29, 0.62]	0.88 [0.77, 0.95]
Stroud 2002	28	57	2	73	0.93 [0.78, 0.99]	0.56 [0.47, 0.65]
Sugimoto 2010	8	0	2	6	0.80 [0.44, 0.97]	1.00 [0.54, 1.00]
Watanabe ES 2006, Ohshige ES 2012	30	8	3	49	0.91 [0.76, 0.98]	0.86 [0.74, 0.94]
Total	439	336	85	563	0.83 [0.72, 0.91]	0.79 [0.67, 0.88]

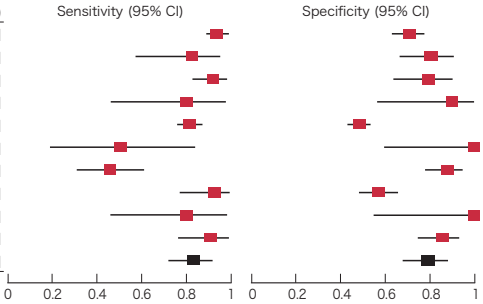

Figure 2: Comparison of the sensitivity and specificity of screening for aspiration using cervical auscultation.

Note: ES, expiratory sound; SS, swallowing sound; TP, true positive; FP, false positive; FN, false negative; TN, true negative.

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Inoue 2005, 2007	62	8	5	30	0.93 [0.83, 0.98]	0.79 [0.63, 0.90]
Nozue ES 2017	111	165	81	195	0.58 [0.50, 0.65]	0.54 [0.49, 0.59]
Shaw 2004	18	8	22	57	0.45 [0.29, 0.62]	0.88 [0.77, 0.95]
Sugimoto 2010	8	0	2	6	0.80 [0.44, 0.97]	1.00 [0.54, 1.00]
Watanabe ES 2006, Ohshige ES 2012	30	8	3	49	0.91 [0.76, 0.98]	0.86 [0.74, 0.94]
Total	229	189	113	337	0.78 [0.56, 0.91]	0.65 [0.67, 0.88]

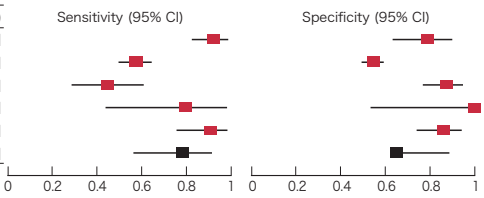

Figure 3: Comparison of sensitivity and specificity of screening for aspiration using cervical auscultation (breath sounds)

Note: ES, expiratory sound; TP: true-positive; FP: false-positive; FN: false-negative; TN: true-negative.

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Leslie 2004	8	1	2	9	0.80 [0.44, 0.97]	0.90 [0.55, 1.00]
Nozue ES 2017	139	181	53	179	0.72 [0.65, 0.79]	0.50 [0.44, 0.55]
Santamato 2009	4	0	4	7	0.50 [0.16, 0.84]	1.00 [0.59, 1.00]
Stroud 2002	28	57	2	73	0.93 [0.78, 0.99]	0.56 [0.47, 0.65]
Watanabe SS 2006, Ohshige SS 2012	18	2	15	55	0.55 [0.36, 0.72]	0.96 [0.88, 1.00]
Total	197	241	76	323	0.70 [0.53, 0.83]	0.85 [0.54, 0.97]

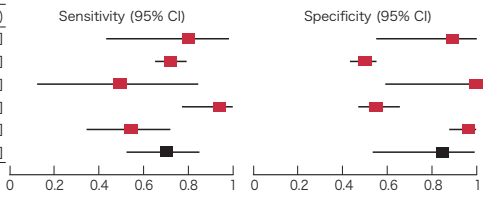

Figure 4: Comparison of the sensitivity and specificity of screening for aspiration using cervical auscultation (swallowing sounds)

Note: ES, expiratory sound; SS, swallowing sound; TP: true-positive; FP: false-positive; FN: false-negative; TN: true-negative.

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5. CQ 7

CQ 7

For persons over 18 years of age suspected of having dysphagia, is it advisable for a nurse who has undergone an educational program to screen for aspiration and pharyngeal residues by observation with an ultrasound diagnostic device?

1) Recommendations

○We propose that persons aged 18 years or older, who are suspected of having dysphagia, receive training in aspiration and pharyngeal residue observation using an ultrasound diagnostic device, and that persons who have been certified by their instructors as being at a level where they can practice aspiration and pharyngeal residue observation techniques using ultrasound diagnostic devices are screened for aspiration using ultrasound diagnostic devices in facilities and home-visit nursing agencies equipped with ultrasound diagnostic devices.

GRADE **2C** (strength of recommendation : **weak**, certainty of evidence (strength) : **weak**)

[Caution] A device connected to a linear probe should be provided. The probe should have a bandwidth in the frequency range of 5-15 MHz. The resolution of the instrument should be at a level that can clearly delineate the contours of the thyroid cartilage and epiglottis.

2) Background and purpose

A definitive diagnosis of dysphagia is made at medical institutions using VF and VE. At home, endoscopic swallowing observation is used because VF is not available. The endoscope allows the observation of the swallowing function, organic lesions, aspiration, penetration, and residues. However, aspiration cannot be directly observed because of whiteout. In contrast, observation with an ultrasound device can confirm the presence or absence of aspiration and residual aspiration with a minimally invasive observation method. Therefore, it is advisable to first screen for aspiration and pharyngeal residue using minimally invasive ultrasound and then proceed to endoscopic observation if a more detailed observation is considered necessary.

For the screening of patients with dysphagia based on the swallowing function, the The Oto-Rhino-Laryngological Society of Japan has published the "Guidelines for the Treatment of Dysphagia, 2018 Edition."[1] This guideline does not mention observation with an ultrasound diagnostic device. The Japanese Society of Dysphagia Rehabilitation and Medical Review Committee published "Evaluation of Dysphagia 2019" [2] This manual mainly describes various evaluation methods for dysphagia used in Japan, but does not mention observation using an ultrasound device. Outside Japan, the National Clinical Guideline for Oropharyngeal Dysphagia screening and assessment and selected initiatives, such as SST (DK) - Danish Health Authority[3] does not mention screening with ultrasound devices.

Therefore, in this CQ, we examined evidence from the domestic and international literature on the sensitivity and specificity of screening for dysphagia (aspiration, pharyngeal residues) by observation with an ultrasound

device, mainly in patients aged 18 years or older suspected of having dysphagia. The reference standard for checking sensitivity and specificity was VF or VE.

3) Explanation

Cross-sectional observational studies or cohort studies were selected. The articles used in this systematic review were four cross-sectional studies on screening with ultrasound devices for the detection of aspiration and one cross-sectional study for the detection of pharyngeal residue.

One study observed movement of the hyoid bone, one study observed movement of the tongue, and three studies observed aspiration or residual food bolus or liquid in the trachea, all of which were observed with an ultrasound device.

A study[4] in which the movement of the hyoid bone during swallowing was observed using an ultrasound device was conducted on 52 patients with dysphagia (86.5% of them were stroke patients) aged 61.2 ± 16.4 years in the rehabilitation department of a general hospital in Korea. The prevalence of aspiration and penetration was 60%. The distance traveled by the hyoid bone was observed using an ultrasound system in B-mode during swallowing of 5 mL of liquid with contrast medium in an upright, neck-straight position. The results showed that the sensitivity and specificity of detection of aspiration were 0.84 (95% CI: 0.66–0.95) and 0.81 (95% CI: 0.58–0.95), respectively, with the reference standard being VF performed on the same day, with the cutoff point being 13.5 mm. The sensitivity and specificity values were high.

In another study, the vertical movement of the tongue associated with swallowing saliva or liquid was measured in 100 acute stroke patients aged 72.2 ± 10.7 years in a 30-degree head-up position using an ultrasound machine in M-mode[5]. The prevalence of dysphagia was found to be 24%. When the reference standard was VF and the cutoff point was the velocity of the upward movement of the tongue during swallowing (63.55 Â mm/s), the sensitivity for detecting aspiration was 0.83 (95% CI: 0.63–0.95) and the specificity was 0.88 (95% CI: 0.79–0.94). Both were high.

A study of aspiration mass detection was conducted in the outpatient dysphagia clinic of a general hospital in Japan.[6] Seventeen dysphagic patients aged 70 ± 7.6 years were asked to swallow thickened liquids and solids, and an ultrasound device was used to detect aspirated boluses in the trachea using B-mode. Using VF/VE as the reference standard, the sensitivity of aspiration was low, at 0.64 (95% CI: 0.31–0.89), and the specificity was high, at 0.84 (95% CI: 0.66–0.95).

In addition, a study[7] attempted to increase the sensitivity of aspiration by adding image processing to these images. Seventeen patients in an outpatient eating and swallowing clinic were asked to swallow thickened liquids and solids, and when they underwent VE or VF, B-mode video was simultaneously captured with an ultrasound machine. The images were processed to sharpen the images and colorize the aspiration findings for observation. The sensitivity for aspiration detection was 0.91 (95% CI: 0.59–1.00) and the specificity was 0.94 (95% CI: 0.79–0.99). The researchers noted that aspiration of low-viscosity liquids was particularly difficult to detect by naked eye observation alone because of the short detection time.

A meta-analysis of four studies on aspiration detection by ultrasound showed a high sensitivity of 0.82 (95% CI: 0.72–0.89) and specificity of 0.87 (95% CI: 0.81–0.92). All studies showed no or low-risk factors that might reduce the quality of evidence. Of the studies included in the systematic review, two of four studies were performed by physicians and two were performed by nurses. We did not downgrade the evidence due to indirectness because the quality of the assessments was considered to be assured if the nurses had received an educa-

tional program on how to perform and observe ultrasound examinations and had been certified by their supervisors as being able to perform them. Uncertainty was judged as "none" and publication bias as "unlikely." As a result, the certainty (strength) of the evidence was judged to be C (weak).

Regarding pharyngeal residue, there is a study[8] in which the nurses attempted to detect pharyngeal residue with an ultrasound diagnostic device in nine patients, over the age of 60, who swallowed thickened liquids and solids in an outpatient swallowing clinic at a general hospital in Japan.[8] In the case of pharyngeal residues, the ultrasound system showed a high echo area on the vocal cords. Using VE as the reference standard, the prevalence of pharyngeal residue was 68%, and the sensitivity and specificity of the ultrasound system for detecting pharyngeal residue were both low, at 0.62 (95% CI: 0.32–0.86) and 0.67 (95% CI: 0.22–0.96), respectively. For residues in the pharynx, only one study was included in the systematic review, and the number of subjects was small. Therefore, we judged the factors that might reduce the quality of evidence to be "serious" for imprecision and "none" for publication bias. The final strength of the evidence was judged to be D (very weak).

The overall strength of evidence for the sensitivity and specificity of screening for dysphagia using ultrasound devices was C (weak) because there are only a few studies available for systematic review[9] and the number of subjects for both aspiration and residues in the pharynx is small.

In addition to the certainty of the evidence, the main issues discussed at the panel meeting to determine the recommendation were the potential for disadvantages to the subject, cost, subject intentions, reliability and feasibility of the assessment methods, and non-directiveness of the studies included in the systematic review. Regarding the strength of the recommendation, patients with false-positive results as a result of observations on ultrasound devices may be subjected to unnecessary VE or VF testing or dietary restrictions. Patients with false-negative results are at risk of being offered diets that are not appropriate for their swallowing function, which may be detrimental. Therefore, efforts should be made to reduce the number of false positives and false negatives based on dietary observations and other screening results, even if this increases the time and effort spent on testing.

Although it is costly to install an ultrasound system, it is relatively easy to implement screening in facilities where ultrasound systems are used for other purposes. However, it is essential to educate the implementers to take images and make decisions that will enable screening. Results of the voting indicated that 5 of the 8 members voted for "weak recommendation,"2 for "strong recommendation," and 1 for "no recommendation." Of all the members, 63% voted in favor of the proposal, which was not enough to reach the standard of 2/3 approval. However, since it is a less-invasive test and the benefits are expected to outweigh the disadvantages, and since the cost of the test may demotivate with the use of the test, it was decided to provide a "weak recommendation for implementation" to promote the use of the test in clinical practice in the future.

Based on the above, the strength of the recommendation and evidence for this CQ is GRADE 2C (strength of recommendation: weak, certainty of evidence (strength): weak).

4) Database search results

Aspiration pneumonia, aspiration, assess, evaluate, deglutition disorders, deglutition, swallow, dysphagia, echo tomograph, echography, sonography, echotomography, esophagus, pharynx, oropharynx, pneumonia, screening, predict, test, tests, detect, ultrasonography, ultrasound, (swallowing disorders, swallowing pneumonia, intra-airway aspiration, aspiration pneumonia, test, detect, aspiration, aspiration pneumonia, screening, residual, ultrasound, pneumonia-swallowing, evaluation (in Japanese), were used as keywords. The databases used were PubMed (until August 31, 2019), Embase (until August 31, 2019), CINAHL (until August 31, 2019),

Cochrane Library (until August 31, 2019), and Ichushi-Web (until August 31, 2019). As a result, 770 studies were identified, and five observational studies were recruited after screening. The database search formulas are included in the appendix.

5) Literature search flowchart

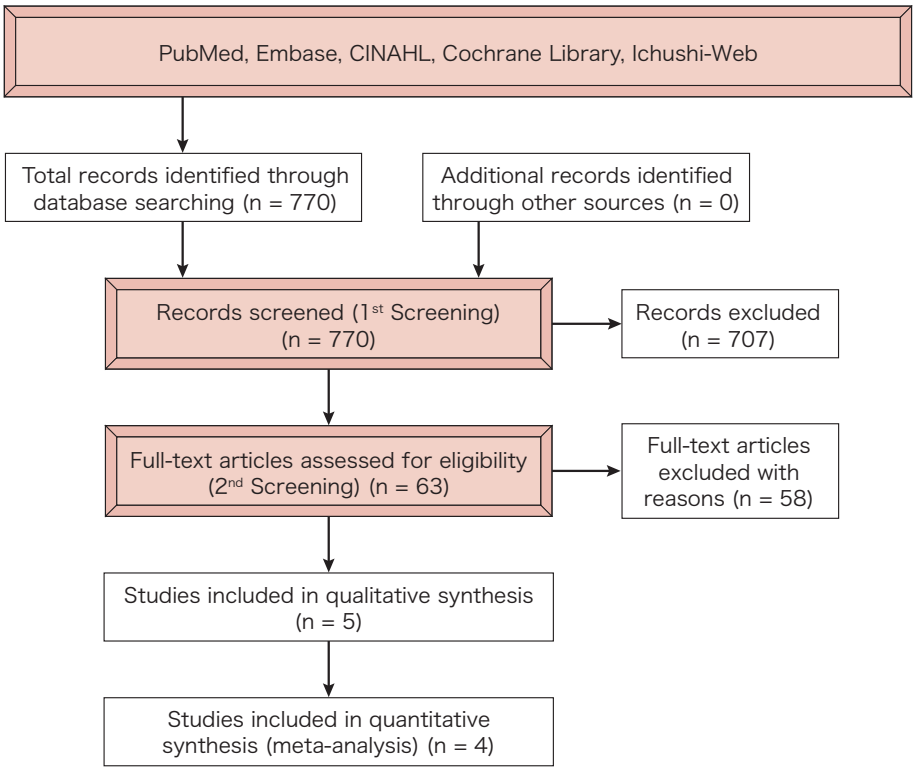

Figure 1: Literature search flowchart

6) List after secondary screening

Table 1: List after secondary screening

Literature	Design	P	Index test	Reference standard	O	Exclusion	Comment
Miura, 2014	Cross-sectional study	Persons 60 years of age or older who have undergone VE or VF testing	Assessing the presence of aspiration by looking at processed ultrasound images	VE/VF	Sensitivity and specificity of aspiration detection		
Miura, 2014	Cross-sectional study	Patients with dysphagia	Determining aspiration with ultrasound device	VE/VF	Sensitivity and specificity of aspiration detection		
Lee, 2016	Cross-sectional study	52 patients with dysphagia	Using an ultrasound machine, calculating the distance of hyoid bone movement and comparing it with healthy subjects, and detecting penetration and aspiration.	VF	Sensitivity and specificity of predicting penetration and aspiration		
Tomii, 2011	Cross-sectional study	Stroke patients with dysphagia	Speed of tongue movement measured in M-mode.	VF	Sensitivity and specificity of aspiration detection		
Miura, 2016	Cross-sectional study	Those who have been tested by VE	Ultrasound system detects the presence of residue in the epiglottic valley	VE	Sensitivity and specificity of pharyngeal residue detection		

7) List of included papers

Table 2: List of included papers

Included papers	Lee YS, Lee KE, Kang Y, et al.	Usefulness of submental ultrasonographic evaluation for dysphagia. Ann Rehabil Med 2016; 40(2):197-205.
Included papers	Tomii Y, Matsuoka H, Torii T, et al.	A new ultrasound method for evaluating dysphagia in acute stroke patients. Int J Stroke 2011; 6(3):279-280.
Included papers	Miura Y, Nakagami G, Yabunaka K, et al.	Method for detection of aspiration based on B-mode video ultrasonography. Radiol Phys Technol 2014; 7(2):290-295
Included papers	Miura Y, Nakagami G, Yabunaka K, et al.	Method for detecting aspiration based on image processing-assisted B-mode video ultrasonography. J Nurs Sci Engineer 2014; 1(1):12-20
Included papers	Miura Y, Nakagami G, Yabunaka K, et al.	Detecting pharyngeal post-swallow residue by ultrasound examination: a series. Med Ultrason 2016; 18(3):288-293

8) Qualitative systematic review

Table 3: Qualitative systematic review

CQ	7	For persons over 18 years of age suspected of having dysphagia, is it advisable for a nurse who has undergone an educational program to screen for aspiration and pharyngeal residues by observation with an ultrasound diagnostic device?
P		Persons over 18 years of age with suspected dysphagia
I		Observation with an ultrasound diagnostic device
C		VF or VE
Clinical context		Observation with an ultrasound diagnostic device is a minimally invasive method to check for aspiration and pharyngeal residue. Therefore, it is advisable to first screen for aspiration and pharyngeal residue by minimally invasive ultrasound observation and then proceed to endoscopic observation if a more detailed observation is necessary.
O1		True positives, true negatives, false positives, and false negatives in aspiration detection
Summary of indirectness		Decided "none."
The risk of bias summary		In some cases, the examiners were not blinded to the results of the index test or reference standard, or it was unclear whether they were blinded; hence, the risk of bias was judged to be "unlikely."
Inconsistency and other summary		Sensitivity and specificity varied, and inconsistency was judged to be "unlikely."
Comment		All studies had no or low risk of factors that might reduce the quality of evidence but had small sample sizes and low precision.
O2		True positives, true negatives, false positives, and false negatives in the detection of pharyngeal residue
Summary of indirectness		Decided "none."
The risk of bias summary		It was unclear whether the examiners were blinded to the results of the reference standard, and the risk of bias was determined to be "unlikely."
Inconsistency and other summary		The inaccuracy was judged to be "serious" because only one paper was included in the study.
Comment		Only one paper was included in the study and the sample size was small.

9) Meta-analysis

A meta-analysis of four studies that focused on the detection of aspiration by an ultrasound device showed a sensitivity of 0.82 (95% CI: 0.72–0.89) and a specificity of 0.87 (95% CI: 0.81–0.92) (**Figure 2**).

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Lee 2016	26	4	5	17	0.84 [0.66, 0.95]	0.81 [0.58, 0.95]
Miura 2014a	7	5	4	26	0.64 [0.31, 0.89]	0.84 [0.66, 0.95]
Miura 2014b	10	2	1	29	0.91 [0.59, 1.00]	0.94 [0.79, 0.99]
Tomii 2011	20	9	4	67	0.83 [0.63, 0.95]	0.88 [0.79, 0.94]
Total	63	20	14	139	0.82 [0.72, 0.89]	0.87 [0.81, 0.92]

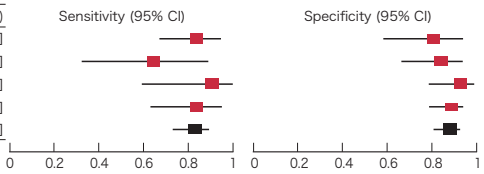

Figure 2: Comparison of sensitivity and specificity of screening for aspiration using an ultrasound diagnostic device.

Note: TP: true positive; FP: false positive; FN: false negative; TN: true negative.

References

1. The Oto-Rhino-Laryngological Society of Japan. Clinical practice guidelines for the diagnosis and management of dysphagia, 2018. Kanehara Publishing, Tokyo, 2018.
2. The Japanese Society of Dysphagia Rehabilitation. Medical Review Committee. Evaluation of Dysphagia. 2019. https://www.jsdr.or.jp/wp-content/uploads/file/doc/assessment2019-announce.pdf
3. National clinical guideline for oropharyngeal dysphagia – screening, assessment and selected initiatives. Danish Health Authority, Copenhagen, 2016.
4. Lee YS, Lee KE, Kang Y, et al. Usefulness of submental ultrasonographic evaluation for dysphagia. Ann Rehabil Med 2016; **40**(2): 197-205.
5. Tomii Y, Matsuoka H, Torii T, et al. A new ultrasound method for evaluating dysphagia in acute stroke patients. Int J Stroke 2011; **6**(3): 279-280.
6. Miura Y, Nakagami G, Yabunaka K, et al. Method for detection of aspiration based on B-mode video ultrasonography. Radiol Phys Technol 2014; **7**(2): 290-295.
7. Miura Y, Yabunaka K, Nakagami G, et al. Method for detecting aspiration based on image processing-assisted B-mode video ultrasonography. J Nurs Sci Engineer 2014; **1**(1): 12-20.
8. Miura Y, Nakagami G, Yabunaka K, et al. Detecting pharyngeal post-swallow residue by ultrasound examination: a case series. Med Ultrason 2016; **18**(3): 288-293.
9. Miura Y, Tamai N, Kitamura A, et al. Diagnostic accuracy of ultrasound examination in detecting aspiration and pharyngeal residue in patients with dysphagia: A systematic review and meta-analysis. Jpn J Nurs Sci 2021; **18**(2): e12396

6. CQ 8

CQ 8

For individuals over 18 years of age, who are suspected of having dysphagia, is it acceptable for nurses, who have undergone an educational program, to manage oropharyngeal dysphagia based on observations with an ultrasound diagnostic device and conventional methods?

1) Recommendations

○ We propose that persons over 18 years of age, who are suspected of having dysphagia, receive training in aspiration and pharyngeal residue observation using ultrasound diagnostic devices, and that persons, who have been certified by their instructors as being at a level where they can practice aspiration and pharyngeal residue observation using ultrasound diagnostic devices, provide management of oropharyngeal dysphagia based on observations using ultrasound diagnostic devices in facilities and offices equipped with these devices. In facilities and offices equipped with ultrasound diagnostic devices, we propose to manage oropharyngeal dysphagia based on observations using these devices.

GRADE **2C** (strength of recommendation : **weak**, certainty of evidence (strength) : **weak**)

[Caution] A device connected to a linear probe should be provided. The probe should have a bandwidth in the frequency range of 5–15 MHz. The resolution of the instrument should be at a level that can clearly delineate the contours of the thyroid cartilage and epiglottis.

2) Background and purpose

To prevent aspiration pneumonia, it is necessary to evaluate eating and swallowing functions and provide appropriate management of oropharyngeal dysphagia. Although VF and VE are the gold standard evaluation methods, ultrasound is a non-invasive evaluation method that does not require the insertion of fibers, X-rays, or contrast media compared to VF and VE. This is a non-invasive evaluation method. In addition, it is highly portable and can be used to evaluate residues in the pyriform fossa and epiglottic valley (pharyngeal residues) and aspiration in the patient during daily eating. This makes it useful as a routine evaluation tool. Besides, if subclinical aspiration can be detected, which is difficult in conventional observation scenarios, its usefulness for the management of oropharyngeal dysphagia will be extremely high. However, it is unclear whether managing oropharyngeal dysphagia using conventional observation methods without medical devices or with ultrasound diagnostic devices contributes to improved patient outcomes. In this study, we examined the usefulness of ultrasound-based management of oropharyngeal dysphagia in patients aged 18 years or older suspected of having dysphagia based on domestic and international literature.

3) Explanation

Randomized controlled trials were majorly included; however, observational studies were also included if there were no studies that met the criteria. In the study by Miura et al.[1], residents of a special nursing home who gave consent were divided into an intervention and a control group. The two groups were divided using a stratified randomization method to avoid bias in the prevalence of dysphagia. The intervention group consisted of 23 patients (mean age, 87 years; 6 with dysphagia [prevalence 26.1%]), and the control group consisted of 23 patients (mean age, 85 years; 5 with dysphagia, 21.7%). The intervention included observations for aspiration and pharyngeal residue four times using an ultrasound diagnostic device during meals for eight weeks (once every two weeks), and making recommendations for the management of oropharyngeal dysphagia based on the observations. Management of oropharyngeal dysphagia was presented in an algorithm, where alternating swallowing was taught if pharyngeal residue was observed by the ultrasound diagnostic equipment. Changes in the food form and evaluation by VE were recommended if aspiration was observed. The frequency of aspiration and pharyngeal residue in both groups before the commencement of the study and 8 weeks after initiating the intervention was assessed using ultrasound. The percentage of patients with decreased aspiration frequency was 4.3% in the intervention group and 13.0% in the control group. The median percentage of patients with reduced aspiration and residue frequency was 31% in the intervention group and 11% in the control group. The odds ratio (OR) for the incidence of aspiration was 0.30 (95% CI: 0.03–3.15) and that for pharyngeal residue was 0.63 (95% CI: 0.10–4.21). Aspiration pneumonia occurred in two patients (8.7%) in the intervention group and one patient (4.3%) in the control group, and the OR for aspiration pneumonia was 2.09 (95% CI: 0.18–24.87). There was no significant reduction in any of the outcomes in the intervention group. The sensitivity and specificity of detection of aspiration by the ultrasound system in B-mode were 91% and 94%, respectively[2], and the sensitivity and specificity of residue in the pharynx after swallowing were 62% and 67%, respectively[3]. Imprecision was judged to be "high (-2)" when the occurrence of aspiration pneumonia was chosen as the outcome, and "medium/doubtful (-1)" when the incidence of aspiration and pharyngeal residue were chosen as the outcomes. Publication bias was judged to be "low (0)" for both groups. Based on the above, the strength of evidence was determined to be "weak."

In addition to the certainty of the evidence, the main issues discussed at the panel meeting to determine the recommendation were the non-directiveness of the studies included in the systematic review, reliability and feasibility of the assessment methods, differences in results depending on the device used, costs, subject intentions, and burden on the subject. The study by Miura et al. was limited to patients aged 65 years and older and did not include middle-aged adult subjects; therefore, caution should be exercised in its application to adult patients aged 18 to 64 years. In addition, with regard to observations on ultrasound devices, it is important to train nurses who understand the anatomy, mechanisms, handling, and characteristics of ultrasound devices related to swallowing. Therefore, although it is a useful examination, it needs to be performed by those who have acquired a certain level of skill and knowledge. The assessment results were also affected by the performance of the ultrasound device used. In addition to training on ultrasound diagnostic devices, education on eating and swallowing rehabilitation is necessary. Besides, evaluation methods using ultrasound devices are not covered by insurance, which may increase the burden in terms of cost. As there are no restrictions on the food to be tested, the food to be used will not deviate greatly from the wishes of the patient. However, as the device will be in contact with the neck, this may not be in accordance with the wishes of the patient. Results of the voting indicated that six out of eight participants voted for a "weak recommendation to perform the intervention," one voted for a "strong rec-

ommendation to perform the intervention," and one voted for "no recommendation," with 75% in favor of a weak recommendation to perform the intervention. Therefore, the strength of the recommendation was set to C (weak).

4) Database search results

Aspiration pneumonia, acoustic, aspiration, dysphagia, care, nursing, deglutition disorder, echography, echotomography, exercise, training, rehabilitation, residue, swallow, sonography, swallowing care, ultrasound, (swallowing care, swallowing support, swallowing rehab, swallowing training, swallowing support, dysphagia, swallowing pneumonia, aspiration in the airway, aspiration pneumonia, aspiration, aspiration pneumonia, residual ultrasound, and pneumonia-swallowing [in Japanese]) were used as keywords. The databases used were PubMed (until August 31, 2019), Embase (until August 31, 2019), CINAHL (until August 31, 2019), Cochrane Library (until August 31, 2019), and Ichushi-Web (until August 31, 2019). As a result, 139 studies were identified, and one randomized controlled trial was conducted after screening. The database search formulae are included in the appendix.

5) Literature search flowchart

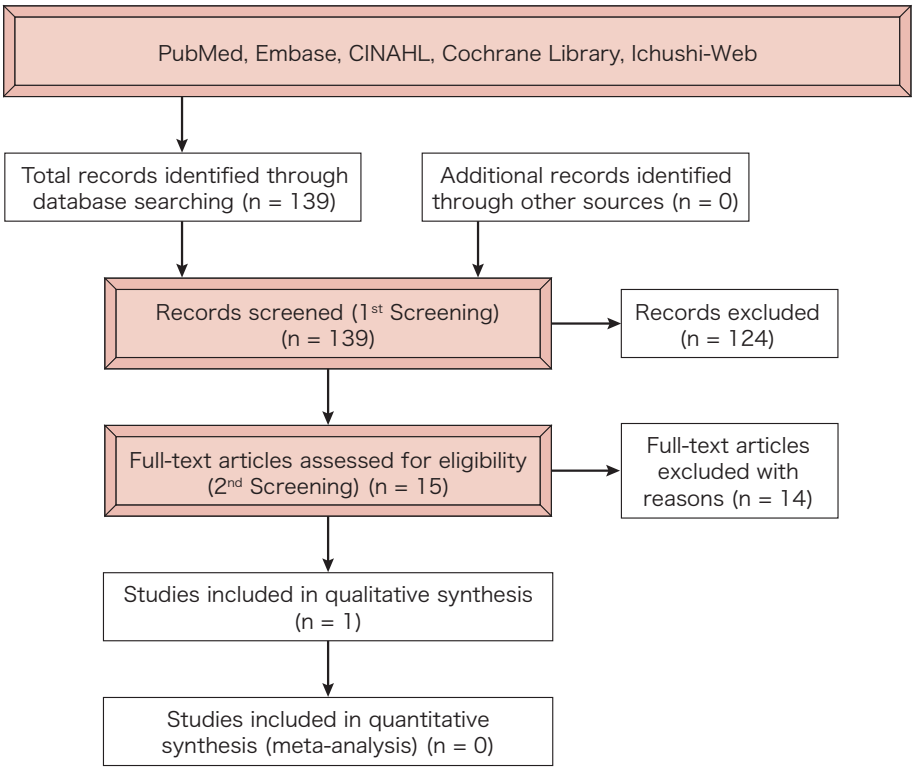

Figure 1: Literature search flowchart

6) List after secondary screening

Table 1: List after secondary screening

Literature	Design	P	I	C	O	Exclusion	Comment
Miura, 2018	Randomized controlled trial	Institutionalized patients 65 years and older suspected of having dysphagia	Recommendations for care through observation using ultrasound diagnostic devices	Care based on the observation of meals	Incidence of aspiration pneumonia, frequency of aspiration and pharyngeal residue		

7) List of included papers

Table 2: List of included papers

Included papers	Miura Y, Nakagami G, Yabunaka K, et al.	A randomized controlled trial to investigate the effectiveness of the prevention of aspiration pneumonia using recommendations for swallowing care guided by ultrasound examination. Healthcare 2018; 6(1): 15.

8) Qualitative systematic review

Table 3: Qualitative systematic review

CQ	8	For individuals over 18 years of age, who are suspected of having dysphagia, is it acceptable for nurses, who have undergone an educational program, to manage oropharyngeal dysphagia based on observations with an ultrasound diagnostic device and conventional methods?
P		Persons over 18 years of age suspected of having dysphagia
I		Recommendations for the management of oropharyngeal dysphagia based on observations with an ultrasound device
C		Management of oropharyngeal dysphagia through observation by conventional methods
Clinical context		Observation with an ultrasound diagnostic device is a minimally invasive method to check for aspiration and pharyngeal residue. Therefore, it is advisable to first screen for aspiration and pharyngeal residue by minimally invasive ultrasound and then proceed to endoscopic observation if a more detailed observation is necessary. Observation with an ultrasound diagnostic device is used as a screening test for selecting an appropriate management strategy for oropharyngeal dysphagia.
O1		Occurrence of aspiration pneumonia
Summary of indirectness		The study was limited to subjects aged 65 years and older and did not include middle-aged adults (aged 18 to 65 years). Considering the possibility that the outcome may be affected by age, we downgraded the grade and judged the study as "medium/suspicious (-1)."
The risk of bias summary		It was judged to be "low (0)."
Inconsistency and other summary		For imprecision, the sample size was too small to produce an effect estimate and it was judged to be "high (-2)."
Comment.		Two patients (8.7%) in the intervention group and one patient (4.3%) in the control group had aspiration pneumonia, and the OR for aspiration pneumonia was 2.09 (95% CI: 0.18–24.87). However, there was no significant difference between the different interventions.
O2		Incidence of aspiration
Summary of indirectness		The study was limited to subjects aged 65 years and older and did not include middle-aged subjects. Considering the possibility that the outcome may be affected by age, we downgraded the grade and judged the study as "medium/suspicious (-1)."
The risk of bias summary		It was judged to be "low (0)."
Inconsistency and other summary		For imprecision, the sample size was too small to produce an effect estimate and it was judged to be "medium/doubtful (-1)."
Comment		The OR for the incidence of aspiration was 0.30 (95% CI: 0.03–3.15), and there was no significant difference between the different interventions.
O3		Residue rate of pyriform fossa
Summary of indirectness		The study was limited to subjects aged 65 years and older and did not include middle-aged subjects. Considering the possibility that the outcome may be affected by age, we downgraded the grade and judged the study as "medium/suspicious (-1)."
The risk of bias summary		It was judged to be "low (0)."
Inconsistency and other summary		For imprecision, the sample size was too small to produce an effect estimate and it was judged to be "medium/doubtful (-1)."
Comment		The OR for pharyngeal residue rate was 0.63 (95% CI: 0.10–4.21), and there was no significant difference between the different interventions.

References

1. Miura Y, Nakagami G, Yabunaka K, et al. A randomized controlled trial to investigate the effectiveness of the prevention of aspiration pneumonia using recommendations for swallowing care guided by ultrasound examination. Healthcare 2018; **6**(1): 15.
2. Miura Y, Nakagami G, Yabunaka K, et al. Method for detecting aspiration based on image processing-assisted B-mode video ultrasonography. J Nur Sci Eng 2014; **1**(1): 12-20.
3. Miura Y, Nakagami G, Yabunaka K, et al. Detecting pharyngeal post-swallow residue by ultrasound examination: a case series. Med Ultrason 2016; **18**(3): 288-293.

7. CQ 9

CQ 9

For persons over 18 years of age, who are suspected of having dysphagia, should a nurse who has undergone an educational program observe aspiration and pharyngeal residue using an endoscope?

1) Recommendations

○ This is an area where evidence is expected to accumulate with the development of future research, and research should be planned in a well-considered clinical environment. Certified nurses in dysphagia nursing and nurses with specialized knowledge and experience in eating and swallowing, who have received training in the endoscopic observation of aspiration and pharyngeal residue and who have been certified by a medical advisor as being able to practice the observation technique, can perform endoscopic observation of aspiration and pharyngeal residue in clinical settings.

GRADE **None** (strength of recommendation : **None**, quality of evidence (strength) : **weak**)

2) Background and purpose

Swallowing endoscopy is an act that falls under the category of medical assistance that can be performed by nurses. Although the percentage is low, at 0.2–0.6%[1),2)], there are records of nurses performing swallowing observations using endoscopes. Here, swallowing observation by nurses using an endoscope falls under the category of medical practice. In this guideline, endoscopic swallowing observation by nurses is defined as the observation of the pharyngeal cavity with an endoscope inserted through the nasal cavity into the soft palate. Certified nurses in the field of dysphagia nursing who have been trained in endoscopic aspiration and residual pharyngeal observation have the knowledge and skills necessary to perform endoscopic swallowing observations.

However, the sensitivity and specificity of endoscopic observations of aspiration and pharyngeal residue by educated nurses are unknown. In this study, we have investigated for the degree of agreement between nurses' and physicians' assessments.

3) Explanation

Cross-sectional observational or cohort studies were included. No articles that presented evidence for this CQ and met the criteria were extracted. However, certified nurses with dysphagia have the knowledge and skills necessary to perform eating and swallowing function assessments. They attend endoscopic examinations performed by physicians or dentists who specialize in eating and swallowing rehabilitation in clinical practice and evaluate patients' eating and swallowing functions as team members, from the images obtained.

In the panel meeting to determine the recommendation, the main issues discussed were the intention of the subject, burden on the subject, reliability and feasibility of the evaluation method, and possibility of future research and practice. The observation method involves inserting an endoscope from the nasal cavity to the soft

palate, and since there is almost no pain and it is possible to use foods that match the subject's preferences, in very few cases, this method deviates greatly from the patient's preferences. With regard to the reliability and feasibility of the evaluation method, an educational program for certified nurses in the field of dysphagia nursing to perform endoscopy and observe aspiration and pharyngeal residue has recently been developed, and the safety and accuracy of the evaluation have been reported.[3] Three certified nurses in dysphagia nursing attended the educational program and practiced endoscopic swallowing observation on patients. No adverse events occurred during the practice. The concordance of the evaluation between the three certified nurses and a physician specialized in swallowing rehabilitation was 92.8–94.8% in 10 cases, and 100% in 11 cases. The usefulness of a systematic educational program for swallowing endoscopy has been suggested overseas.[4] Results of voting indicated that 1 out of 8 participants voted for "weak recommendation for not performing," 1 voted for "strong recommendation for performing," 1 for "weak recommendation for performing," and 5 for "no decision on the recommendation." Therefore, the strength of the recommendation was set to "none." There is a strong need to continue discussing this CQ in the future.

4) Database search results

Agreement, concordance, aspiration, deglutition disorder, endoscope, endoscopic assessment, endoscopic evaluation, endoscopy, fiberendoscopic evaluation, interrater, inter-rater, intra-rater, intrarater, pneumonia, swallowing, observer variation, (agreement, disagreement, agreement rate, swallowing, dysphagia, swallowing pneumonia, inter-observer agreement, interobserver variation, intraobserver, interobserver, intraobserver, aspiration pneumonia, aspiration, aspiration pneumonia, endoscopy, pneumonia-aspiration, interrater, intra-rater, interrater, intra-rater, discrepancy [in Japanese]) were used as keywords. The databases included PubMed (until August 31, 2019), Embase (until August 31, 2019), CINAHL (until August 31, 2019), Cochrane Library (until August 31, 2019), and Ichushi-web (until August 31, 2019). As a result, 212 studies were identified, and no articles were adopted as a result of screening. The database search formulae are included in the appendix.

5) Literature search flowchart

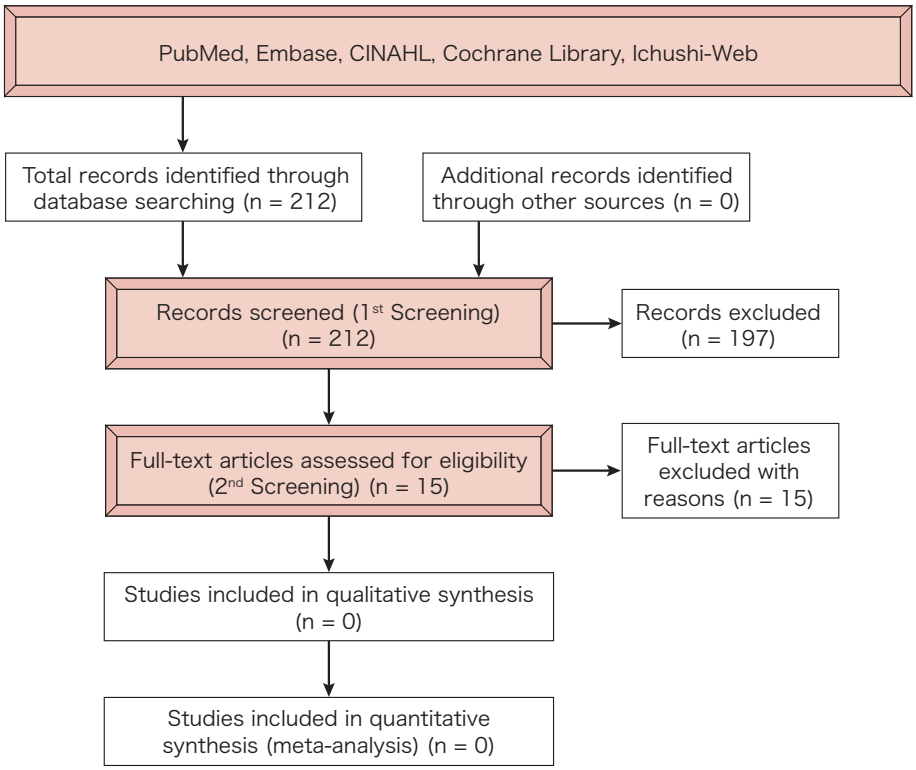

Figure 1: Literature search flowchart

References

1. 2010 Ministry of Health, Labour and Welfare. Special Scientific Research Project, Survey of Nursing Practice, Research on Scope of Medical Practice Performed by Nurses. https://www.mhlw.go.jp/stf2/shingi2/2r9852000000sk2r-att/2r9852000000sk5k.pdf (in Japanese)
2. Japan Medical Association. Japan Medical Association Survey. Survey on the scope of medical practice performed by nursing staff. http://dl.med.or.jp/dl-med/teireikaiken/20101111_3.pdf (in Japanese)
3. Yoshida M, Kagaya H, Kamakura Y, et al. Safety and the effectiveness of a new education program for nurses to assess swallowing function using fiberoptic endoscopic evaluation of swallowing. Jpn J Nurs Sci 2020; **17**(2): e12313.
4. Dziewas R, Glahn J, Helfer C, et al. Flexible endoscopic evaluation of swallowing (FEES) for neurogenic dysphagia: training curriculum of the German Society of Neurology and the German stroke society. BMC Med Educ 2016; **16**: 70.

8. CQ 10

CQ 10

Should the management of oropharyngeal dysphagia for persons aged 18 years or older and suspected of having dysphagia be based on endoscopic observation of aspiration and pharyngeal residue by nurses (who have undergone an educational program) in addition to conventional management?

1) Recommendations

○ This is an area where evidence is expected to accumulate with the development of future research, and research should be planned in a well-considered clinical environment. Certified nurses in dysphagia nursing and nurses with specialized knowledge and experience in the field of dysphagia, who have received training in the endoscopic observation of aspiration and pharyngeal residue and who have been certified by a supervising physician as being able to practice observation techniques, can manage oropharyngeal dysphagia.

GRADE **None** (strength of recommendation : **None**, quality of evidence (strength) : **weak**)

2) Background and purpose

VE is a swallowing function assessment that can be performed repeatedly at the bedside or at home if the swallowing function is visualized and the necessary device is used. In the 2018 edition of the Guidelines for the Treatment of Dysphagia[1] prepared by the The Oto-Rhino-Laryngological Society of Japan, an endoscopic evaluation of the swallowing function should be performed by a physician familiar with the anatomy and physiology of the pharynx and larynx to ascertain the state of swallowing and select appropriate treatment options.

In contrast, VE is an act that falls under the category of medical assistance that can be performed by nurses. Although the percentage is low, at 0.2–0.6%[2,3], there is a track record of nurses performing swallowing observations using endoscopes. Certified nurses in dysphagia nursing acquire the necessary knowledge and skills (15 hours) to assess the function of eating and swallowing during the nurse education/certification program, and have the ability to perform physical assessment techniques and screening tests and assess the severity and level of the eating status.

However, it is unclear whether conventional management of oropharyngeal dysphagia or endoscopic observation by trained nurses contributes to better outcomes. In the present study, we have investigated the effects of both.

3) Explanation

Randomized controlled trials were included as evidence. Observational studies were also included if none of the studies met the criteria. No articles that provided evidence for this CQ and met the criteria were extracted. In contrast, the 2018 edition of the The Oto-Rhino-Laryngological Society of Japan guidelines[1] states, "Endoscopic swallowing evaluation is recommended as an examination to assess swallowing status and select treatment

options." However, we were not able to extract any article that provided evidence for this CQ, including the references cited in the guidelines.

In the panel meeting to determine the recommendation, the main issues discussed were the intention of the subject, burden on the subject, reliability and feasibility of the evaluation method, and possibility of future research and practice. The observation method involves inserting an endoscope from the nasal cavity to the soft palate, and since there is almost no pain and it is possible to use foods that match the subject's preferences, the method may deviate greatly from patients' preferences only in few cases. With regard to the reliability and feasibility of the evaluation method, certified nurses in the field of dysphagia nursing have the knowledge and skills necessary to conduct a functional evaluation of eating and swallowing, attend a VE conducted by a physician or dentist specializing in eating and swallowing rehabilitation in a clinical setting, and use the images to evaluate the patient's eating and swallowing function. They evaluated the patient's eating and swallowing functions as team members. They also exchanged opinions as team members on the content of management of oropharyngeal dysphagia based on the results, implemented the management of oropharyngeal dysphagia, and educated other nurses to help them implement it as well.

Recently, an educational program was developed for certified nurses in the field of dysphagia nursing to observe aspiration and pharyngeal residue using an endoscope and to evaluate eating and swallowing functions. Although the study was conducted on a small number of patients at a single institution, the safety of the program and accuracy of the evaluation have been reported[4]. Furthermore, the usefulness of a systematic VE education program has been suggested overseas. Results of the voting indicated that 1 out of 8 people voted for "weak recommendation for not implementing," 1 voted for "strong recommendation for implementing," 1 for "weak recommendation for implementing," and 5 for "no judgment on the recommendation." Therefore, the strength of recommendation was set to "none." There is a strong need to continue discussing this CQ in the future.

4) Database search results

Aspiration pneumonia, aspiration, deglutition disorder, dysphagia, aspirate, endoscopy nurse endoscopy, nurse endoscopist, non-physician endoscope, nurse specialist, education, nurse's role, nurse practitioners, nurse-performed endoscope, nursing, trained nurse, pneumonia, practice nursing, residue, deglutition, speech-language, endoscope, swallow, advanced,(swallow, dysphagia, swallowing pneumonia, nursing education, nurse's role, aspiration pneumonia, aspiration, aspiration pneumonia, articulatory language, advanced professional nursing practice, professional nurse, endoscope, endoscopic nursing, nurse practitioner, pneumonia-swallowable [in Japanese]) were used as keywords. The databases included PubMed (until August 31, 2019), Embase (until August 31, 2019), CINAHL (until August 31, 2019), Cochrane Library (until August 31, 2019), and Ichushi-Web (until August 31, 2019). As a result, 419 studies were identified, and no articles were adopted as a result of screening. The database search formulae are included in the appendix.

5) Literature search flowchart

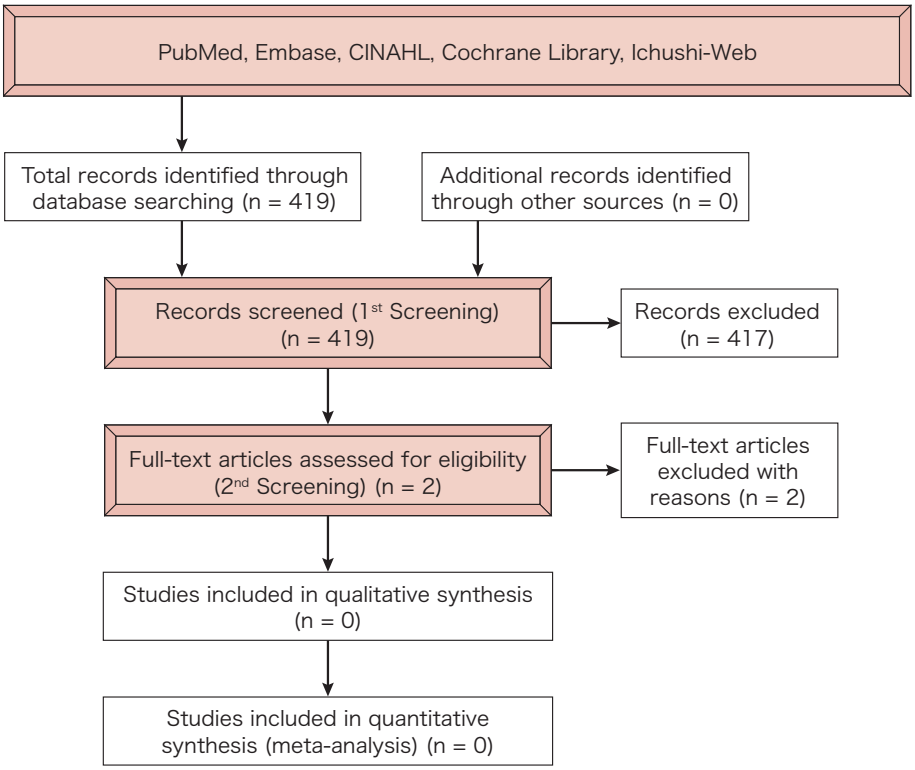

Figure 1: Literature search flowchart

References

1. The Oto-Rhino-Laryngological Society of Japan. Clinical Practice Guidelines for the Diagnosis and Management of Dysphagia 2018. Kanehara Publishing Co. 2018. (in Japanese)
2. 2010 Ministry of Health, Labour and Welfare. Special Scientific Research Project, Survey of Nursing Practice, Research on Scope of Medical Practice Performed by Nurses. https://www.mhlw.go.jp/stf2/shingi2/2r9852000000sk2r-att/2r9852000000sk5k.pdf (in Japanese)
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4. Yoshida M, Kagaya H, Kamakura Y, et al. Safety and the effectiveness of a new education program for nurses to assess swallowing function using fiberoptic endoscopic evaluation of swallowing. Jpn J Nurs Sci 2020; **17**(2): e12313.
5. Dziewas R, Glahn J, Helfer C, et al. Flexible endoscopic evaluation of swallowing (FEES) for neurogenic dysphagia: training curriculum of the German Society of Neurology and the German stroke society. BMC Med Educ 2016; **16**: 70.

9. Summary for the public

The purpose of this guideline is to provide a protocol for nurses to make decisions on how to support people with impaired eating and swallowing functions, based on findings in the literature, the balance of advantages and disadvantages, the values of the patient, and other multifaceted factors. In this section, we discuss how nurses can make decisions. In this section, we explain the 10 clinical questions (CQs) that were formulated based on the assumption that nurses would be asked to make decisions and describe what kind of decisions are recommended.

CQ 1

It is advisable to perform a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia? To avoid duplication with CQs 3, 4, 5, and 6, assessments using only the Repetitive Saliva Swallowing Test (RSST), Modified Water Swallowing Test (MWST), Food Test (FT), or cervical auscultation were not included here.

Recommendations

○ We propose to conduct an assessment of aspiration through a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) for individuals aged 18 years and older, who are suspected of having dysphagia.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] When including observation items that require an understanding of instructional actions, such as command swallowing of water, care should be taken while applying the process to persons with impaired consciousness or severe cognitive impairment.

Physical assessment techniques are methods of assessing impairment in eating and swallowing functions based on daily observations of the patient's condition and are widely used in hospitals, convalescent homes, and at home.

The evaluation will be based on information obtained from a person suspected of having eating or swallowing dysfunction and that obtained from their family members, and observations made by the medical staff. For example, we will ask about the history of illnesses, whether the patient had problems eating or swallowing, whether the patient had difficulty breathing, and whether the patient was receiving sufficient nutrition. The medical staff will also visually observe the patient's face and around and inside the mouth, tactilely check the movement of the throat and chest with their hands, and listen to chest sounds using a stethoscope. In addition, an evaluation will be made based on the loudness of the voice and smoothness of the speech during a conversation. These physical assessment techniques are often performed first or on a regular basis for people who are suspected of having eating or swallowing dysfunction before screening tests such as RWST, MWST, and FT. Since it does not require any device, it can be performed in a nursing home or at home.

Commonly used screening methods to evaluate impairment in eating and swallowing functions include the RWST, MWST, and FT. RWST is a method of assessing whether a person is at high risk of food or saliva entering the trachea by determining how many times they can repeatedly swallow saliva in 30 seconds. MWST evaluates the ability to successfully swallow 3 mL of cold water. FT asks the patient to eat a mouthful (about 4 g) of jelly or pudding and assesses whether the patient can swallow it successfully.

In this study, we examined whether the use of physical assessment techniques can be recommended as a method of assessing eating and swallowing dysfunction in adults who are suspected of having eating and swallowing dysfunction.

As a result, it was determined that the use of physical assessment techniques for the evaluation of impaired eating and swallowing functions is "weakly recommended (suggested)," based on a review. The review emphasizes the ability to correctly determine whether food is entering the trachea and whether food remains in the back of the throat based on multiple reports that mention that physical assessment techniques can correctly determine, to some extent, the above parameters. Besides, there is no burden, such as pain. On the other hand, physical examination techniques require a medical professional with some training.

CQ 2

Is it advisable to manage oropharyngeal dysphagia based on a systematic assessment using physical assessment techniques (interview, visual inspection, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia. To avoid duplication with CQs 3, 4, 5, and 6, assessments using only Repetitive Saliva Swallowing Test (RSST), Modified Water Swallowing Test (MWST), Food Test (FT), or cervical auscultation were not included here.

Recommendations

○ We propose to manage oropharyngeal dysphagia based on a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] Subsequent screening and diagnostic tests based on a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) are necessary for the implementation of appropriate care.

We explored the question of whether the use of physical assessment techniques is advisable to manage eating and swallowing dysfunction in persons (adults) suspected of having them.

As a result, after considering the importance of reducing pneumonia, the use of physical assessment techniques in the care of patients with eating and swallowing dysfunction was judged to be a "weak recommendation (suggestion)." This was based on the following factors: (1) it has been reported that the care of patients with eating and swallowing dysfunction based on information from physical assessment techniques may reduce pneumonia; (2) there is no burden, such as pain; and (3) on the other hand, sufficient training is required to correctly

assess eating and swallowing dysfunction.

CQ 3

Is it advisable to screen for aspiration by Repetitive Saliva Swallowing Test (RSST) in persons over 18 years of age suspected of having dysphagia?

Recommendations

○We suggest that individuals aged 18 years and older, who are suspected of having dysphagia, should be screened for aspiration using Repetitive Saliva Swallowing Test (RSST).

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] Repetitive Saliva Swallowing Test (RSST) requires movement with an understanding of instructions, and caution should be exercised regarding its application to persons with impaired consciousness or severe cognitive impairment. Caution should be exercised when applying Repetitive Saliva Swallowing Test (RSST) to patients with xerostomia. Patients with Parkinson's syndrome, who have strong immobility and inactive, are often judged to be abnormal, regardless of their swallowing function.

CQ 4

Is it advisable to screen for aspiration using the Modified Water Swallowing Test (MWST) in persons over 18 years of age, who are suspected of having dysphagia?

Recommendations

○We suggest screening for aspiration with the MWST in individuals aged 18 years and older, who are suspected of having dysphagia.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] To prevent aspiration of oral bacteria, the mouth should be cleaned before performing the procedure; Modified Water Swallowing Test (MWST) requires movement with an understanding of instructions, and caution should be exercised regarding its application to persons with impaired consciousness or severe cognitive impairment.

CQ 5

Is it advisable to screen for aspiration by FT (Food Test) for persons over 18 years of age, who are suspected of having dysphagia?

Recommendations

○It is suggested to screen individuals aged 18 years or older suspected of having dysphagia for aspiration using FT (Food Test).

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] To prevent aspiration of oral bacteria, the mouth should be cleaned before performing the procedure; FT (Food Test) requires movement with an understanding of instructions, and care should be taken regarding its application to persons with impaired consciousness or severe cognitive impairment.

The term "screening" usually means "sifting"; however, in this context, it refers to using simple tests to quickly assess whether a person has impaired eating and swallowing functions. Screening can identify eating and swallowing difficulties at an early stage; therefore, the problems can be addressed immediately and further testing can be performed soon. In this way, aspiration, in which food enters the trachea, and pharyngeal residue, in which food remains in the back of the throat, can be prevented at an early stage, and the development of pneumonia can be prevented. Aspiration and pharyngeal residue can be a daily life problem for people with impaired eating and swallowing functions. This is because food that goes into the trachea or remains in the back of the throat may contain bacteria from the mouth. This bacteria-laden food may eventually travel from the trachea to the bronchi and lungs, causing inflammation in the lungs. This is called "aspiration pneumonia." To prevent pneumonia, it is necessary to properly assess eating and swallowing functions and provide meals that match these functions. In addition, if a patient is unable to expel food residue in the back of the throat using his/her own coughing ability, it is necessary to remove it by inserting a catheter through the mouth into the back of the throat and sucking it out or by swallowing some jelly or other food that passes easily down the throat.

To determine what kind of food to serve and whether food in the back of the throat needs to be removed, it is necessary to ensure that there is food present in the trachea and back of the throat. When food enters the trachea and coughing is weak, the cough may not be able to remove it. Therefore, food may repeatedly flow into the lungs through the trachea, eventually leading to pneumonia.

The commonly used methods of screening for aspiration and pharyngeal residue include the RSST, MWST, and FT. These tests can be performed anywhere, including nursing homes and at home, without the use of special testing instruments.

CQs 3, 4, and 5 examined whether the use of RSST, MWST, and FT is recommended for adults suspected of having impairments in eating and swallowing functions.

The recommendation was based on correctly determining whether food enters the trachea and remains in the back of the throat. From the results, we determined that utilizing RSST, MWST, and FT is weakly recommended (suggested). This was based on the following factors: the report that these tests can correctly determine, to some extent, whether food enters the trachea and remains in the back of the throat; the fact that there is no burden of pain or distress; and the low cost or short time involved. On the other hand, the accuracy of determination has not yet been confirmed in a sufficient number of subjects. Besides, RSST is difficult to evaluate in people with severely dry mouths or those with difficulty understanding the test procedure. MWST is a safe test because it uses a small amount of water but some people may have difficulty swallowing too little. You can start with a small amount of water and see how well it is swallowed, then increase the amount of water, and see how well it is swallowed. In FT, since the test is performed with a small amount of food, there is a risk that food enters or gets stuck in the trachea (choking). These screening methods are already widely used in clinical practice and in the calculation of nursing care fees.

CQ 6

Is it advisable to screen for aspiration and pharyngeal residues by cervical auscultation in persons aged 18 years or older, who are suspected of having dysphagia?

Recommendations

○Screening for aspiration and pharyngeal residues swallowing by cervical auscultation should be performed in individuals aged 18 years and older, who are suspected of having dysphagia.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] Education on screening for aspiration and pharyngeal residues is needed for nurses who perform cervical auscultation.

Cervical auscultation is a method of determining whether food or water has entered the trachea or remains in the back of the throat by listening to the sounds heard from the trachea before and after swallowing and from the throat while swallowing, using a stethoscope. The stethoscope is placed outside the trachea or neck to listen to the sounds. Since the stethoscope is only placed on the skin, it is easy to use and can be performed on people who have difficulty in understanding and following instructions of the medical personnel.

Cervical auscultation is a screening method that can be used to easily identify problems with eating and swallowing functions.

This CQ examines whether the use of cervical auscultation is recommended as a screening method for adults suspected of having impaired eating and swallowing functions.

The use of cervical auscultation was judged to be "weakly recommended (suggested)" after considering whether the use of screening tests is recommended and whether cervical auscultation can correctly determine whether food enters the trachea and remains in the back of the throat. This was based on multiple reports that confirmed that cervical auscultation can correctly determine the above. Moreover, sounds heard with a stethoscope can be judged correctly by a medical professional with a certain amount of training; therefore, we made a comprehensive judgment.

CQ 7

For persons over 18 years of age suspected of having dysphagia, is it advisable for a nurse who has undergone an educational program to screen for aspiration and pharyngeal residues by observation with an ultrasound diagnostic device?

Recommendations

○We propose that persons aged 18 years or older, who are suspected of having dysphagia, receive training in aspiration and pharyngeal residue observation using an ultrasound diagnostic device, and that persons who have been certified by their instructors as being at a level where they can practice aspiration and pharyngeal residue observation techniques using ultrasound diagnostic devices are

screened for aspiration using ultrasound diagnostic devices in facilities and home-visit nursing agencies equipped with ultrasound diagnostic devices.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] A device connected to a linear probe should be provided. The probe should have a bandwidth in the frequency range of 5–15 MHz. The resolution of the instrument should be at a level that can clearly delineate the contours of the thyroid cartilage and epiglottis.

To check for the presence of food in the trachea and throat, the following methods have been used: swallowing food containing barium and confirming its position by X-ray examination or inserting a very thin camera through the nose and observing the back of the throat. Recently, ultrasound diagnostic devices have been used to confirm the presence of food in the trachea and throat. An ultrasound diagnostic device emits sound inaudible to the human ear and uses differences in intensities between sounds sent and received to examine body functions. It is possible to see the inside of the body simply by applying the instrument on the bosy surface; therefore, there is almost no pain during the examination. It is also possible to see food in the trachea and back of the throat without using special chemicals, such as barium. Recently, these devices have become increasingly small, and it is now possible to take the device home for examination. We examined whether the use of ultrasound is recommended as a screening method for people suspected of having eating or swallowing dysfunction.

Using a diagnostic ultrasound diagnostic device was weakly recommended (suggested) after considering whether it can correctly determine if food flows into the trachea and remains in the back of the throat. The recommendation is based on a report that states that an ultrasound device can correctly determine the above, to some extent. However, observation and image interpretation must be performed and judged by medical professionals with some training. Observation using ultrasound devices is less painful and can be done without using special chemicals, and we can expect more reports on the accuracy of this method in the future.

CQ 8

For individuals over 18 years of age, who are suspected of having dysphagia, is it acceptable for nurses, who have undergone an educational program, to manage oropharyngeal dysphagia based on observations with an ultrasound diagnostic device and conventional methods?

Recommendations

○ We propose that persons over 18 years of age, who are suspected of having dysphagia, receive training in aspiration and pharyngeal residue observation using ultrasound diagnostic devices, and that persons, who have been certified by their instructors as being at a level where they can practice aspiration and pharyngeal residue observation using ultrasound diagnostic devices, provide management of oropharyngeal dysphagia based on observations using ultrasound diagnostic devices in facilities and offices equipped with these devices. In facilities and offices equipped with ultrasound diagnostic devices, we propose to manage

oropharyngeal dysphagia based on observations using these devices.

GRADE 2C (strength of recommendation : weak, certainty of evidence (strength) : weak)

[Caution] A device connected to a linear probe should be provided. The probe should have a bandwidth in the frequency range of 5–15 MHz. The resolution of the instrument should be at a level that can clearly delineate the contours of the thyroid cartilage and epiglottis.

We examined whether using an ultrasound diagnostic device is recommended for selecting care for people (adults) suspected of having eating and swallowing dysfunction.

After focusing on reducing pneumonia and reducing the food flowing into the trachea and that remaining in the back of the throat, it was determined that using an ultrasound diagnostic device for selecting care for people with eating and swallowing dysfunction was weakly recommended (suggested). Previous studies have shown that using an ultrasound diagnostic device to observe food in the trachea and back of the throat to select care for people with eating and swallowing dysfunction tends to reduce the amount of food that enters the trachea and remain in the back of the throat. Ultrasonography is less painful, but there is a lack of clear data showing that using the results of ultrasound for care selection can help prevent pneumonia. Therefore, recommendations were made based on these reports and their merits. Observation using an ultrasound diagnostic device should be performed by a person with sufficient knowledge and skills. In addition, there are no reports on whether observation using an ultrasound diagnostic device leads to an improvement in quality of life or whether it is cost effective; therefore, further studies are needed. Since observation using ultrasound is less painful and can be performed without using special chemicals, it is expected that there will be more reports on the effects of using this method in the future.

CQ 9

For persons over 18 years of age, who are suspected of having dysphagia, should a nurse who has undergone an educational program observe aspiration and pharyngeal residue using an endoscope?

Recommendations

○ This is an area where evidence is expected to accumulate with the development of future research, and research should be planned in a well-considered clinical environment. Certified nurses in dysphagia nursing and nurses with specialized knowledge and experience in eating and swallowing, who have received training in the endoscopic observation of aspiration and pharyngeal residue and who have been certified by a medical advisor as being able to practice the observation technique, can perform endoscopic observation of aspiration and pharyngeal residue in clinical settings.

GRADE None (strength of recommendation : None, quality of evidence (strength) : weak)

Endoscopic swallowing is a procedure in which a thin camera is inserted through the nose to the front of the

throat to evaluate the impairment of eating and swallowing functions. The camera allows us to observe how food and water flow into the back of the throat and stay there. The thin camera can be carried to a medical facility or even to your home, allowing medical staff to perform the examination anywhere. This method of using an endoscope to evaluate impairment in eating and swallowing functions has been recommended in previous guidelines as a test for doctors to diagnose impairment and select treatment options.

Endoscopic swallowing observation is legally recognized as a procedure performed by nurses, which is performed in clinical settings. Certified nurses in dysphagia nursing have sufficient knowledge of the eating and swallowing functions to perform physical assessment techniques, screening tests, and assessments of severity of the disorder and degree to which the patient can eat. Nurses are trained and certified to evaluate the severity of disability and how well the patient is eating. This training includes training in endoscopic swallowing.

We examined whether endoscopic observation by nurses is recommended as a method of assessing eating and swallowing dysfunction in adults suspected of having them.

We focused on whether nurses' assessments of whether food entered the trachea and remained in the back of the throat were consistent with physicians' assessments. However, there are no reports that answer this question yet. Therefore, we are currently not at a point where we can make specific recommendations at this time. In a recent report, certified nurses were trained to perform endoscopic observations of eating and swallowing functions, and it was possible to perform the observations safely without food getting stuck in the back of the patient's throat during the observation or the patient getting pneumonia after the examination. It was also reported that as the experience with making observations increased, doctors' evaluations and nurses' evaluations were in perfect agreement. A training method has been developed to enable nurses to evaluate endoscopic observations as precisely as physicians, and we can expect to see more reports on evaluations by trained nurses in the future.

CQ 10

Should the management of oropharyngeal dysphagia for persons aged 18 years or older and suspected of having dysphagia be based on endoscopic observation of aspiration and pharyngeal residue by nurses (who have undergone an educational program) in addition to conventional management?

Recommendations

○ This is an area where evidence is expected to accumulate with the development of future research, and research should be planned in a well-considered clinical environment. Certified nurses in dysphagia nursing and nurses with specialized knowledge and experience in the field of dysphagia, who have received training in the endoscopic observation of aspiration and pharyngeal residue and who have been certified by a supervising physician as being able to practice observation techniques, can manage oropharyngeal dysphagia.

GRADE None (strength of recommendation : None, quality of evidence (strength) : weak)

We examined whether endoscopic observation by nurses is recommended as a method of assessing eating and

swallowing dysfunction in adults suspected of having these.

This study focused on whether endoscopic observation by nurses, in addition to the usual treatment of eating and swallowing problems, could reduce pneumonia. However, there is no report yet on whether it can reduce pneumonia. Therefore, we are currently not at a point where we can make specific recommendations for this question. Training nurses in endoscopic observation is already being conducted for nurses who have specialized knowledge and skills and are certified. We can expect to see more reports on the effectiveness of this method in the future.

Appendix

1. Setting table of clinical questions

Key clinical issue 1

Key clinical issue(s) addressed in the scope.					
Is it useful to conduct a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) to assess aspiration and pharyngeal residue during eating and swallowing in adults with dysphagia?					
Components of CQ					
P (Patients, Problem, Population)					
Gender	No designation				
Age	Over 18 years old				
Diseases and conditions	Persons suspected of having dysphagia				
Geographic requirements	None in particular				
Other	None in particular				
List of I's (Interventions)/C's (Comparisons, Controls)					
I: Assessment by physical assessment C: Conventional observation of dysphagia only. Outcome is adopted when the score is 5 or more.					
O (Outcomes) list					
	Content of outcome	Benefit or harm	Priority		Included or excluded
O1	Occurrence of aspiration pneumonia	Benefit	9	points	Included
O2	Incidence of aspiration	Benefit	8	points	Included
O3	Residue rate in pyriform fossa	Benefit	7	points	Included
O4	Residue rate in the epiglottic valley	Benefit	7	points	Included
O5	Sensitivity and specificity of aspiration detection (ref: detection by VE/VF)	Benefit	6.3	points	Included
O6	Sensitivity and specificity of residue detection in the laryngeal trough (ref: detection by VE/VF)	Benefit	6.3	points	Included
O7	Sensitivity and specificity of residue detection in the pyriform fossa (ref: detection by VE/VF)	Benefit	5.5	points	Included
O8	Sensitivity and specificity of penetration detection	Benefit	5.5	points	Included
O9	Sensitivity and specificity of determination of the severity of dysphagia (ref: detection by VE/VF)	Benefit	7.5	points	Included
O10	Sensitivity and specificity of risk determination for aspiration pneumonia	Benefit	6.3	points	Included
Created CQ					
CQ1. It is advisable to perform a systematic assessment using physical assessment techniques (interview, visual examination, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia? CQ2. Is it advisable to manage oropharyngeal dysphagia based on a systematic assessment using physical assessment techniques (interview, visual inspection, auscultation, palpation, and percussion) for persons aged 18 years and older suspected of having dysphagia?					

Key clinical issue 2

Key clinical issue(s) addressed in the scope.					
What aspiration and oropharyngeal residue screening tests are useful for adults with dysphagia to assess aspiration and oropharyngeal residue during eating and swallowing?					
Components of CQ					
P (Patients, Problem, Population)					
Gender	No designation				
Age	Over 18 years old				
Diseases and conditions	Persons suspected of having dysphagia				
Geographic requirements	Places where an ultrasound system with a linear probe is available.				
Other	Exclusion; patients with cancers of the tongue, pharynx and larynx and patients with tracheostomy				
List of I's (Interventions)/C's (Comparisons, Controls)					
I: RSST I: MWST I: FT I: Cervical auscultation I: Observation using an ultrasound diagnostic device C: Conventional observation of dysphagia only. An outcome is adopted when the score is 5 or more.					
O (Outcomes) list					
	Content of outcome	Benefit or harm	Priority		Included or excluded
O1	Occurrence of aspiration pneumonia	Benefit	9	points	Included
O2	Incidence of aspiration	Benefit	8	points	Included
O3	Residue rate in the pyriform fossa	Benefit	7	points	Included
O4	Residue rate in the epiglottic valley	Benefit	7	points	Included
O5	Sensitivity and specificity of aspiration detection (ref: detection by VE/VF)	Benefit	6.3	points	Included
O6	Sensitivity and specificity of residue detection in the laryngeal trough (ref: detection by VE/VF)	Benefit	6.3	points	Included
O7	Sensitivity and specificity of residue detection in the pyriform fossa (ref: detection by VE/VF)	Benefit	7.6	points	Included
O8	Sensitivity and specificity of penetration detection	Benefit	6.5	points	Included
O9	Sensitivity and specificity for determining the severity of dysphagia (ref: detection by VE/VF)	Benefit	7	points	Included
O10	Sensitivity and specificity of risk determination for aspiration pneumonia	Benefit	7.5	points	Included
Created CQ					
CQ3. Is it advisable to screen for aspiration by RSST (repetitive saliva swallowing test) in persons over 18 years of age who are suspected of having dysphagia? CQ4. Is it advisable to screen for aspiration using MWST (modified water swallowing test) in persons over 18 years of age who are suspected of having dysphagia? CQ5. Is it advisable to screen for aspiration by FT (food test) in persons over 18 years of age who are suspected of having dysphagia? CQ6. Is it advisable to screen for aspiration and pharyngeal residue using cervical auscultation in persons over 18 years of age who are suspected of having dysphagia? CQ7. Is it advisable for a nurse with an educational program to screen for aspiration and pharyngeal residue by observation with an ultrasound diagnostic device for persons aged 18 years and older who are suspected of having dysphagia? CQ8. For those aged 18 years or older and suspected of having dysphagia, should nurses who have undergone an educational program manage oropharyngeal dysphagia based on the results of observation with an ultrasound device and using conventional methods?					

Key clinical issue 3

Key clinical issue(s) addressed in the scope					
For adults with dysphagia, is it useful for nurses to use an endoscope to assess for aspiration and pharyngeal residue during eating and swallowing?					
Components of CQ					
P (Patients, Problem, Population)					
Gender	No designation				
Age	Over 18 years old				
Diseases and conditions	Persons suspected of having dysphagia				
Geographic requirements	Places where an endoscopy device is available.				
Other	None in particular				
List of I's (Interventions)/C's (Comparisons, Controls)					
I: Endoscopic observation by a trained nurse C: Endoscopic examination by a doctor. Outcome is adopted when the score is 5 points or more.					
O (Outcomes) list					
	Content of outcome	Benefit or harm	Priority		Included or excleded
O1	Occurrence of aspiration pneumonia	Benefit	9	points	Included
O2	Incidence of aspiration	Benefit	8	points	Included
O3	Residue rate in the pyriform fossa	Benefit	7	points	Included
O4	Residue rate in the epiglottic valley	Benefit	7	points	Included
O5	Sensitivity and specificity of aspiration detection (ref: detection by physician)	Benefit	6.3	points	Included
O6	Sensitivity and specificity of residue detection in the laryngeal trough (ref: detection by Dr. V)	Benefit	6.3	points	Included
O7	Sensitivity and specificity of residue detection in the pyriform fossa (ref: detection by physicians)	Benefit	8	points	Included
O8	Sensitivity and specificity of detection of penetration (ref: detection by physicians)	Benefit	7.6	points	Included
O9	Sensitivity and specificity of severity classification of dysphagia (ref: detection by physicians)	Benefit	7.3	points	Included
O10	Sensitivity and specificity of risk determination for aspiration pneumonia	Benefit	7.6	points	Included
Created CQ					
CQ9. For persons over 18 years of age, who are suspected of having dysphagia, should a nurse who has undergone an educational program observe aspiration and pharyngeal residue using an endoscope? CQ10. Should the management of oropharyngeal dysphagia for persons aged 18 years or older and suspected of having dysphagia be based on endoscopic observation of aspiration and pharyngeal residue by nurses (who have undergone an educational program) in addition to conventional management?					

2. Database search formula, evidence evaluation sheet, evidence synthesis sheet

(1) CQ 1

①Database search formula

PubMed

#1	Search "Pneumonia, Aspiration"[mh] OR "Deglutition Disorders"[mh]
#2	Search aspiration pneumonia*[tiab] OR deglutition disorder*[tiab] OR dysphagia[tiab]
#3	Search #1 or #2
#4	Search bedside assessment*[tiab] OR bedside screen*[tiab] OR bedside evaluation*[tiab] OR physical examination*[tiab] OR physical assessment*[tiab] OR clinical assessment*[tiab]
#5	Search screen*[tiab] OR detect*[tiab]
#6	Search "Sensitivity and Specificity"[mh]
#7	Search "sensitivity and specificity"[tiab] OR predictive value*[tiab]
#8	Search #5 or #6 or #7
#9	Search #3 and #4 and #8
#10	Search "Deglutition Disorders/diagnosis"[majr]
#11	Search #4 and #10
#12	Search #9 or #11

Embase

S1	((EMB.EXACT.EXPLODE("aspiration pneumonia") OR EMB.EXACT.EXPLODE("dysphagia")))
S2	((TI,AB((aspiration N/2 pneumonia*) OR (deglutition N/2 disorder*) OR (swallowing N/2 disorder*) OR dysphagia*)))
S3	((S1 or S2))
S4	(TI,AB((bedside N/2 (assessment* OR screen* OR evaluation*)) OR (physical N/2 (examination* OR assessment*)) OR (clinical N/2 assessment*)))
S5	(TI,AB(screen* OR detect*))
S6	(EMB.EXACT.EXPLODE("sensitivity and specificity"))
S7	(TI,AB("sensitivity and specificity" OR (predictive P/2 value*)))
S8	(S5 or S6 or S7)
S9	(S3 and S4 and S8)
S10	(MJEMB.EXACT("dysphagia -- diagnosis"))
S11	(S4 and S10)
S12	(S9 or S11)

CINAHL

S1	MH "Pneumonia, Aspiration" OR MH "Deglutition Disorders"
S2	(aspiration N2 pneumonia*) OR (deglutition N2 disorder*) OR dysphagia*
S3	S1 OR S2
S4	(bedside N2 (assessment* OR screen* OR evaluation*)) OR (physical N2 (examination* OR assessment*)) OR (clinical N2 assessment*)
S5	screen* OR detect*
S6	MH "Sensitivity and Specificity"
S7	"sensitivity and specificity" OR (predictive W2 value*)
S8	S5 or S6 or S7
S9	S3 and S4 and S8
S10	(MM "Deglutition Disorders/DI")
S11	S4 and S10
S12	S9 or S11

Cochrane Library

#1	[mh "Pneumonia, Aspiration"] OR [mh "Deglutition Disorders"]
#2	((aspiration NEAR/2 pneumonia*) OR (deglutition NEAR/2 disorder*) OR dysphagia*):ti,ab,kw
#3	#1 or #2
#4	((bedside NEAR/2 (assessment* OR screen* OR evaluation*)) OR (physical NEAR/2 (examination* OR assessment*)) OR (clinical NEAR/2 assessment*)):ti,ab,kw
#5	(screen* OR detect*):ti,ab,kw
#6	[mh "Sensitivity and Specificity"]
#7	("sensitivity and specificity" OR (predictive NEXT value*)):ti,ab,kw
#8	#5 or #6 or #7
#9	#3 and #4 and #8
#10	[mh "Deglutition Disorders"[mj]/DI]
#11	#4 and #10
#12	#9 or #11
#13	#9 or #11 in Cochrane Reviews, Cochrane Protocols
#14	#9 or #11 in Trials

Ichushi-Web

#1	Pneumonia-aspirated/TH or aspiration pneumonia/AL or swallowed pneumonia/AL or attracted pneumonia/AL (in Japanese)
#2	@Dysphagia/TH or Dysphagia/AL (in Japanese)
#3	#1 or #2
#4	(@Dysphagia/MTH) and (SH=Diagnosis) (in Japanese)
#5	Screening (in Japanese)/AL or screening/AL or evaluation/AL (in Japanese)
#6	Physical Assessment/AL or Bedside Assessment/AL or Physical Assessment/AL or Bedside Assessment/AL or (@Physical Examination/TH or Physical Examination/AL or Physical Examination/AL) (in Japanese)
#7	#3 and #5 and #6
#8	#4 and #6
#9	#7 or #8

②CQ1 Evidence evaluation sheet (outcomes: sensitivity and specificity of aspiration detection)

CQ	CQ1
Patients	18 years old age and older with suspected dysphagia
Index test	Pysical assessment techniques
Control	N.A.
Reference test	VE or VF

*Risk of bias, indirectness
Each domain will be rated on three levels: "high risk," "low risk," and "unknown.
The summary should be reflected in the body of evidence in three levels: "serious", "unlikely", and "none".

Summarize each outcome on a separate sheet.

Outcome			Sensitivity and specificity in detecting aspiration																						
Studies			Risk of bias*					Indirectness*				Number													
ID	Design	Reference test	Selection bias	Index test	Reference test	Flow and timing	Summary	Patients	Index test	Reference test	Summary	TP	FP	TN	FN	Prevalence	95% CI	Sensitivity	95% CI	Specificity	95% CI	Accuracy	95% CI	ROC AUC	95% CI	P-value
Ramsey 2006*	Cross-sectional	VF	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	6	12	35	1	AUC"	95% CI	P-value	0.42, 1.00	0.74	0.60, 0.86	0.76	0.62, 0.87	NA	NA	NA
Toscano 2019*	Cross-sectional	VE	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	28	5	17	0	0.56	0.41, 0.70	1.00	0.88, 1.00	0.77	0.55, 0.92	0.90	0.78, 0.97	NA	NA	NA
Martino 2009*	Cross-sectional	VF	Low risk	Low risk	Low risk	High risk	Unlikely	Low risk	Low risk	Low risk	None	22	14	28	4	0.38	0.27, 0.51	0.85	0.65, 0.96	0.67	0.50, 0.80	0.74	0.61, 0.83	NA	NA	NA
Mann 2000*	Cohort	VF	Low risk	Unknown	Low risk	Unknown	Unlikely	Low risk	Low risk	Low risk	None	26	37	63	2	0.22	0.15, 0.30	0.93	0.76, 0.99	0.63	0.53, 0.72	0.70	0.61, 0.77	NA	NA	NA
González 2011	Cross-sectional	VF	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	36	12	73	5	0.33	0.24, 0.41	0.88	0.74, 0.96	0.86	0.77, 0.92	0.87	0.79, 0.92	NA	NA	NA
Ohira 2017	Cross-sectional	VF	Low risk	Unknown	High risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	15	3	27	5	0.40	0.26, 0.55	0.75	0.51, 0.91	0.90	0.73, 0.98	0.84	0.71, 0.93	NA	NA	NA
Yousovich 2018*	Cross-sectional	VE	Low risk	Unknown	Unknown	Unknown	High risk	Low risk	Low risk	Low risk	Unlikely	31	11	58	6	0.35	0.26, 0.45	0.84	0.68, 0.94	0.84	0.73, 0.92	0.84	0.76, 0.90	NA	NA	NA
Newton 1994*	Cross-sectional	VF	Low risk	Low risk	Unknown	Low risk	Unlikely	Low risk	Low risk	Low risk	None	8	1	3	0	0.67	0.35, 0.90	1.00	0.63, 1.00	0.75	0.19, 0.99	0.92	0.62, 1.00	NA	NA	NA
Baylow 2009*	Cross-sectional	VF	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	2	5	20	3	0.19	0.07, 0.37	0.40	0.05, 0.85	0.80	0.59, 0.93	0.74	0.55, 0.88	NA	NA	NA
Baumann 2017*	Cross-sectional	VE or VF	Low risk	Unknown	Unknown	Low risk	Unlikely	Low risk	Low risk	Low risk	None	59	101	97	40	0.33	0.28, 0.39	0.60	0.49, 0.69	0.49	0.42, 0.56	0.53	0.47, 0.58	NA	NA	NA
Smith 2009*	Cross-sectional	VE or VF	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	19	11	52	14	0.34	0.25, 0.45	0.58	0.39, 0.75	0.83	0.71, 0.91	0.74	0.64, 0.82	NA	NA	NA
Vogel 2017*	Cross-sectional	VF	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	16	19	42	3	0.24	0.15, 0.35	0.84	0.60, 0.97	0.69	0.56, 0.80	0.73	0.61, 0.82	NA	NA	NA
Zhou 2011*	Cross-sectional	VF	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	48	10	43	6	0.50	0.41, 0.60	0.89	0.77, 0.96	0.81	0.68, 0.91	0.85	0.77, 0.91	NA	NA	NA
Mandysova 2011*	Cross-sectional	VE	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	27	33	23	4	0.36	0.26, 0.47	0.87	0.70, 0.96	0.41	0.28, 0.55	0.57	0.46, 0.68	NA	NA	NA
Hey 2013*	Cross-sectional	VE	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	28	13	23	16	0.55	0.43, 0.66	0.64	0.48, 0.78	0.64	0.46, 0.79	0.64	0.52, 0.74	NA	NA	NA
Edmiaston 2014*	Cross-sectional	VF	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	57	81	82	3	0.27	0.21, 0.33	0.95	0.86, 0.99	0.50	0.42, 0.58	0.62	0.56, 0.69	NA	NA	NA
Branco 2019*	Cross-sectional	VF	Low risk	Low risk	High risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	7	3	18	0	0.25	0.11, 0.45	1.00	0.59, 1.00	0.86	0.64, 0.97	0.89	0.72, 0.98	NA	NA	NA
Daniels 1997*	Cross-sectional	VF	Low risk	Unknown	High risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	24	11	22	2	0.44	0.31, 0.58	0.92	0.75, 0.99	0.67	0.48, 0.82	0.78	0.65, 0.88	NA	NA	NA
Nishiwaki 2005*	Cross-sectional	VF	Low risk	Low risk	High risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	13	5	29	14	0.44	0.32, 0.58	0.48	0.29, 0.68	0.85	0.69, 0.95	0.69	0.56, 0.56	NA	NA	NA
Kaege 2017	Cross-sectional	VF	Low risk	Low risk	High risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	8	5	21	4	0.32	0.18, 0.49	0.67	0.35, 0.90	0.81	0.61, 0.93	0.76	0.60, 0.89	NA	NA	NA
Daniels 2016	Cross-sectional	VF	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	27	2	95	126	0.61	0.55, 0.67	0.18	0.12, 0.25	0.98	0.93, 1.00	0.49	0.43, 0.55	NA	NA	NA
Mortensen 2016*	Cross-sectional	VE	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	10	4	28	1	0.26	0.14, 0.41	0.91	0.59, 1.00	0.88	0.71, 0.96	0.88	0.75, 0.96	NA	NA	NA

Comments
*Includes water swallowing test or food test

③CQ1 Evidence synthesis sheet (outcomes: sensitivity and specificity of aspiration detection)

Outcome	N (n)	Design	Factors that may reduce the quality of evidence					Final quality	Effectiveness per 1000 patients	Importance
			Limitation	Indirectness	Inconsistency	Imprecision	Publication bias			
True positive	22 (518)	Cross-sectional	Unlikely	None	Unlikely	None	None	Low	250	6.3
True negative	22 (899)	Cross-sectional	Unlikely	None	Unlikely	None	None	Low	433	6.3
False positive	22 (398)	Cross-sectional	Unlikely	None	Unlikely	None	None	Low	192	6.3
False negative	22 (259)	Cross-sectional	Unlikely	None	Unlikely	None	None	Low	125	6.3
Uncertain results	No reports	–	–	–	–	–	–	–	–	–

④CQ1 Evidence evaluation sheet (outcomes: sensitivity and specificity of risk determination for aspiration pneumonia)

CQ	CQ1
Patients	18 years old age and older with suspected dysphagia
Index test	Pysical assessment techniques
Control	N.A.
Reference test	X-ray, blood test

*Risk of bias, indirectness
Each domain will be rated on three levels: "high risk," "low risk," and "unknown.
The summary should be reflected in the body of evidence in three levels: "serious", "unlikely", and "none".

Summarize each outcome on a separate sheet.

Outcome			Sensitivity and specificity of risk determination for aspiration pneumonia																						
Studies			Risk of bias*					Indirectness*				Number													
ID	Design	Reference test	Selection bias	Index test	Reference test	Flow and timing	Summary	Patients	Index test	Reference test	Summary	TP	FP	TN	FN	Prevalence	95% CI	Sensitivity	95% CI	Specificity	95% CI	Accuracy	95% CI	ROC AUC	95% CI	P-value
Yamane 2015 (Day 2)	Cohort	X-ray, blood test, CT	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	18	39	94	3	0.14	0.09, 0.20	0.86	0.64, 0.97	0.71	0.62, 0.78	0.73	0.65, 0.80	NA	NA	NA
Yamane 2015 (Day 4)	Cohort	X-ray, blood test, CT	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	15	45	91	5	0.13	0.08, 0.19	0.75	0.51, 0.91	0.67	0.58, 0.75	0.68	0.60, 0.75	NA	NA	NA

⑤CQ1 Evidence synthesis sheet (outcomes: sensitivity and specificity of risk determination for aspiration pneumonia)

Outcome	N (n)	Design	Factors that may reduce the quality of evidence					Final quality	Effectiveness per 1000 patients	Importance
			Limitation	Indirectness	Inconsistency	Imprecision	Publication bias			
True positive	1 (18)	Cohort	Unlikely	None	Unlikely	Unlikely	Unlikely	Very low	117	6.3
True negative	1 (94)	Cohort	Unlikely	None	Unlikely	Unlikely	Unlikely	Very low	610	6.3
False positive	1 (39)	Cohort	Unlikely	None	Unlikely	Unlikely	Unlikely	Very low	253	6.3
False negative	1 (3)	Cohort	Unlikely	None	Unlikely	Unlikely	Unlikely	Very low	19	6.3
Uncertain results	No reports	–	–	–	–	–	–	–	–	–

(2) CQ 2

①Database search formula

PubMed

#1	Search "Pneumonia, Aspiration"[mh] OR "Deglutition Disorders"[mh]
#2	Search aspiration pneumonia*[tiab] OR deglutition disorder*[tiab] OR dysphagia[tiab]
#3	Search #1 or #2
#4	Search bedside assessment*[tiab] OR bedside screen*[tiab] OR physical examination*[tiab] OR physical assessment*[tiab]
#5	Search deglutit*[tiab] OR swallow*[tiab]
#6	Search #3 and #4 and #5

Embase

S1	(EMB.EXACT.EXPLODE("aspiration pneumonia") OR EMB.EXACT.EXPLODE("dysphagia"))
S2	(TI,AB((aspiration N/2 pneumonia*) OR (deglutition N/2 disorder*) OR (swallowing N/2 disorder*) OR dysphagia*))
S3	(S1 or S2)
S4	(TI,AB((bedside N/2 (assessment* OR screen*)) OR (physical N/2 (examination* OR assessment*))))
S5	(TI,AB(deglutit* OR swallow*))
S6	(S3 and S4 and S5)

CINAHL

S1	MH "Pneumonia, Aspiration" OR MH "Deglutition Disorders"
S2	(aspiration N2 pneumonia*) OR (deglutition N2 disorder*) OR dysphagia*
S3	S1 OR S2
S4	(bedside N2 (assessment* OR screen*)) OR (physical N2 (examination* OR assessment*))
S5	deglutit* OR swallow*
S6	S3 AND S4 AND S5

Cochrane Library

#1	[mh "Pneumonia, Aspiration"] OR [mh "Deglutition Disorders"]
#2	((aspiration NEAR/2 pneumonia*) OR (deglutition NEAR/2 disorder*) OR dysphagia*):ti,ab,kw
#3	#1 or #2
#4	((bedside NEAR/2 (assessment* OR screen*)) OR (physical NEAR/2 (examination* OR assessment*))):ti,ab,kw
#5	(deglutit* OR swallow*):ti,ab,kw
#6	#3 and #4 and #5
#7	#3 and #4 and #5 in Cochrane Reviews, Cochrane Protocols
#8	#3 and #4 and #5 in Trials

Ichushi-Web

#1	Pneumonia-aspirated/TH or aspiration pneumonia/AL or swallowed pneumonia/AL or attracted pneumonia/AL (in Japanese)
#2	@Dysphagia/TH or Dysphagia/AL (in Japanese)
#3	#1 or #2
#4	Bedside Assessment/AL or (Physical Exam/TH or Physical Exam/AL) (in Japanese)
#5	Physical Assessment/AL (in Japanese)
#6	Swallowing function assessment/AL (in Japanese)
#7	(Aspiration/TH or Aspiration/AL in the airway) or Residual/AL (in Japanese)
#8	Screening (in Japanese)/AL or screening/AL
#9	#7 and #8
#10	#4 or #5 or #6 or #9
#11	Swallowing/TA and Care/TA (in Japanese)
#12	#3 and #10 and #11

②CQ2 Evidence evaluation sheet

CQ	CQ2
Patients	18 years old age and older with suspected dysphagia
Intervention	Management of oropharyngeal dysphagia based on physical assessment techniques
Control	Conventional management of oropharyngeal dysphagia based on conventional observation

* Each item is rated on a scale of "high (-2)", "moderate/doubt (-1)", and "low (0)".
The summary should be reflected in the total evidence on three levels: "high (-2)," "moderate (-1)," and "low (0).

Summarize on a separate sheet for each outcome

Outcome		Incidence of aspiration pneumonia																						
Studies		Risk of bias*										Indirectness*					Number at risk (outcome rate)								
		Selection bias		Exection bias	Detection bias	Case reduction bias		Others																
ID	Design	Randomization	Concealment	Blind	Blind	ITT	Incomplete outcome reporting	Selective outcome reporting	Early study discontinuation	Other bias	Sumarry	Patients	Intervention	Control	Outcome	Sumarry	Control group denominator	Control group numerator	(%)	Intervention group denominator	Intervention group numerator	(%)	Effectiveness index (type)	Effectiveness index (value)	95% CI
Field 2017	RCT	0	0	−2	−2	0	0	0	0	0	−1	0	0	0	0	0	190	6	3.2	192	2	1.0	RR	0.32	0.06,1.62

③CQ2 Evidence synthesis sheet

CQ	CQ2
Patients	18 years old age and older with suspected dysphagia
Intervention	Management of oropharyngeal dysphagia based on physical assessment techniques
Control	Conventional management of oropharyngeal dysphagia based on conventional observation

The strength of evidence starts from "strong (A)" for RCTs and from "weak (C)" for observational studies.
* Each domain has three levels: "high (-2)," "moderate/doubtful (-1)," and "low (0).
** Four levels of evidence strength: "strong (A)," "moderate (B)," "weak (C)," and "very weak (D)."
*** Importance is the importance of the outcome (1-9)

Body of evidence

Outcome	Design/ N	Risk of bias*	Inconsistency*	Imprecision*	Indirectness*	Others (publication bias, etc.)*	Factors of upgrade (Observational study)*	Number at risk (outcome rate)								Strength of evidence**	Importance***
								Control group denominator	Control group numerator	(%)	Intervetn gtup denominate	Intervention group numerator	(%)	Effectiveness index (type)	Effectiveness index (value)	95% CI	
Incidence of aspiration pneumonia	RCT/1	−1	0	−1	0	0	0	190	6	3.2	192	2	1.0	RR	0.32	0.06, 1.62	Weak (C)	9

(3) CQ 3, 4, 5

①Database search formula

PubMed

#1	Search "Pneumonia, Aspiration"[mh] OR "Deglutition Disorders"[mh]
#2	Search aspiration pneumonia*[tiab] OR deglutition disorder*[tiab] OR dysphagia[tiab]
#3	Search (pharyn*[tiab] OR oropharyn*[tiab]) AND (aspirat*[tiab] OR residue*[tiab])
#4	Search #1 or #2 or #3
#5	Search repetitive saliva swallowing test*[tiab] OR repetitive saliva swallow test*[tiab] OR RSST[tiab]
#6	Search modified water swallowing test*[tiab] OR modified water swallow test*[tiab] OR MWST[tiab]
#7	Search food-test*[tiab] OR cough-test*[tiab]
#8	Search swallow*[tiab] AND (function-test*[tiab] OR screening-test*[tiab])
#9	Search #5 or #6 or #7 or #8
#10	Search #4 and #9

Embase

S1	(EMB.EXACT.EXPLODE("aspiration pneumonia") OR EMB.EXACT.EXPLODE("dysphagia"))
S2	(TI,AB((aspiration NEAR pneumonia*) OR (deglutition NEAR disorder*) OR (swallowing NEAR disorder*) OR dysphagia*))
S3	(TI,AB((pharyn* OR oropharyn*) AND (aspirat* OR residue*)))
S4	(S1 OR S2 OR S3)
S5	(TI,AB("repetitive saliva" P/3 swallow* P/3 test* OR RSST))
S6	(TI,AB(modified P/3 water P/3 swallow* P/3 test* OR MWST))
S7	(TI,AB(food P/3 test* OR cough P/3 test*))
S8	(TI,AB(swallow* N/3 (function P/3 test* OR screening P/3 test*)))
S9	(S5 OR S6 OR S7 OR S8)
S10	(S4 AND S9)

CINAHL

S1	MH "Pneumonia, Aspiration" OR MH "Deglutition Disorders"
S2	aspiration pneumonia OR deglutition disorder* OR dysphagia
S3	(pharyn* OR oropharyn*) AND (aspirat* OR residue*)
S4	S1 OR S2 OR S3
S5	repetitive saliva swallow* test* OR RSST
S6	modified water swallow* test* OR MWST
S7	food W3 test* OR cough W3 test*
S8	swallow* N3 ((function W3 test*) OR (screening W3 test*))
S9	S5 OR S6 OR S7 OR S8
S10	S4 AND S9

Cochrane Library

#1	MeSH descriptor: ["Pneumonia, Aspiration"] explode all trees
#2	aspiration pneumonia or deglutition disorder* or dysphagia:ti,ab,kw
#3	(pharyn* OR oropharyn*) and (aspiration* or residue*):ti,ab,kw
#4	#1 or #2 or #3
#5	((repetitive NEXT saliva NEXT swallow* NEXT test*) OR RSST):ti,ab,kw
#6	((modified NEXT water NEXT swallow* NEXT test*) OR MWST):ti,ab,kw
#7	((food NEXT test*) OR (cough NEXT test*)):ti,ab,kw
#8	(swallow* NEAR/3 ((function NEXT test*) OR (screening NEXT test*))):ti,ab,kw
#9	{OR #5-#8}
#10	#4 and #9

Ichushi-Web

#1	Pneumonia-Swallowing/TH or Miswelling Pneumonia/AL or Swallowing Pneumonia/AL or Suction Pneumonia/AL (in Japanese)
#2	@Dysphagia/TH or Dysphagia/AL (in Japanese)
#3	(Swallowing/TH or Swallowing/AL) (in Japanese)
#4	(Aspiration/TH or Aspiration/AL in the airway) or Residual/AL (in Japanese)
#5	#3 and #4
#6	#1 or #2 or #5
#7	RSST/AL or "Repetitive Saliva Swallowing Test"/AL or "Repetitive Saliva Swallow Test"/AL or repetitive saliva swallowing (in Japanese)/AL
#8	MWST/AL or "Modified Water Swallowing Test"/AL or "Modified Water Swallow Test"/AL or modified water swallowing (in Japanese)/AL
#9	Food test/AL or Cough test/AL (in Japanese)
#10	#7 or #8 or #9
#11	Screening/AL or screening/AL or swallowing function/AL (in Japanese)
#12	#6 and #10 and #11

②CQ3 Evidence evaluation sheet (Index test: RSST; outcomes: sensitivity and specificity of aspiration detection)

CQ	CQ3
Patients	18 years old age and older
Index test	RSST (Repetitive Saliva Swallowing Test)
Control	N.A.
Reference test	VE or VF

*Risk of bias, indirectness
Each domain will be rated on three levels: "high risk," "low risk," and "unknown.
The summary should be reflected in the body of evidence in three levels: "serious", "unlikely", and "none".

Summarize each outcome on a separate sheet.

Outcome			Sensitivity and specificity in detecting aspiration																							
Studies			Risk of bias*					Indirectness*				Number														
ID	Design	Reference test	Selection bias	Index test	Reference test	Flow and timing	Summary	Patients	Index test	Reference test	Summary	TP	FP	TN	FN	Prvalence	95% CI	Sensitivity	95% CI	Specificity	95% CI	Accuracy	95% CI	ROC AUC	95% CI	P-value
Oguchi 2000	Cross-sectional	VF	Low risk	Low risk	Unknown	Low risk	Unlikely	Low risk	Low risk	Low risk	None	51	27	52	1	0.40	0.31, 0.49	0.98	0.90, 1.00	0.66	0.54, 0.76	0.79	0.71, 0.85	NA	NA	NA
Watanabe 2007	Cross-sectional	VF	Low risk	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	43	12	8	19	0.76	0.65, 0.84	0.69	0.56, 0.80	0.40	0.19, 0.64	0.62	0.51, 0.73	NA	NA	NA

③CQ3 Evidence synthesis sheet (index test: RSST; outcomes: sensitivity and specificity of aspiration detection)

Outcome	N (n)	Design	Factors that may reduce the quality of evidence					Final quality	Effectiveness per 1000 patients	Importance
			Limitation	Indirectness	Inconsistency	Imprecision	Publication bias			
True positive	2 (94)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	441	6.3
True negative	2 (60)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	282	6.3
False positive	2 (39)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	183	6.3
False negative	2 (20)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	94	6.3
Uncertain results	No reports	—	—	—	—	—	—	—	—	—

④CQ4 Evidence evaluation sheet (index test: MWST; outcomes: sensitivity and specificity of aspiration detection)

CQ	CQ4
Patients	18 years old age and older
Index test	MWST (Modified Water Swallowing Test)
Control	N.A.
Reference test	VE or VF

*Risk of bias, indirectness
Each domain will be rated on three levels: "high risk," "low risk," and "unknown.
The summary should be reflected in the body of evidence in three levels: "serious", "unlikely", and "none".

Summarize each outcome on a separate sheet.

Outcome			Sensitivity and specificity in detecting aspiration																								
Studies			Risk of bias*					Indirectness*				Number															
ID	Design	Reference test	Selection bias	Index test	Reference test	Flow and timing	Summary	Patients	Index test	Reference test	Summary	TP	FP	TN	FN	Prevalence	95% CI	Sensitivity	95% CI	Specificity	95% CI	Accuracy	95% CI	ROC AUC	95% CI	Prevalence
Watanabe 2007	Cross-sectional	VF	Low risk	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	45	12	9	18	0.75	0.64, 0.84	0.71	0.59, 0.82	0.43	0.22, 0.66	0.64	0.53, 0.74	NA	NA	NA
Osawa 2012	Cross-sectional	VF	Low risk	Low risk	Unknown	Low risk	Unlikely	Low risk	Low risk	Low risk	None	29	29	76	21	0.32	0.25, 0.40	0.58	0.43, 0.72	0.72	0.63, 0.81	0.68	0.60, 0.75	NA	NA	NA

⑤CQ4 Evidence synthesis sheet (index test: MWST; outcomes: sensitivity and specificity of aspiration detection)

Outcome	N (n)	Design	Factors that may reduce the quality of evidence					Final quality	Effectiveness per 1000 patients	Importance
			Limitation	Indirectness	Inconsistency	Imprecision	Publication bias			
True positive	2 (74)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	310	6.3
True negative	2 (85)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	356	6.3
False positive	2 (41)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	172	6.3
False negative	2 (39)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	163	6.3
Uncertain results	No reports	–	–	–	–	–	–	–	–	–

⑥CQ4 Evidence evaluation sheet (index test: MWST; outcomes: sensitivity and specificity of pharyngeal residue detection)

CQ	CQ4
Patients	18 years old age and older
Index test	MWST (Modified Water Swallowing Test)
Control	N.A.
Reference test	VE or VF

*Risk of bias, indirectness
Each domain will be rated on three levels: "high risk," "low risk," and "unknown.
The summary should be reflected in the body of evidence in three levels: "serious", "unlikely", and "none".

Summarize each outcome on a separate sheet.

Outcome			Sensitivity and specificity in detecting pharyngeal residue																								
Studies			Risk of bias*					Indirectness*				Number															
ID	Design	Reference test	Selection bias	Index test	Reference test	Flow and timing	Summary	Patients	Index test	Reference test	Summary	TP	FP	TN	FN	Prevalence	95% CI	Sensitivity	95% CI	Specificity	95% CI	Accuracy	95% CI	ROC AUC	95% CI	Prevalence
Osawa 2012	Cross-sectional	VF	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	17	41	74	23	0.26	0.19, 0.33	0.43	0.27, 0.59	0.64	0.55, 0.73	0.59	0.51, 0.67	NA	NA	NA

⑦CQ4 Evidence synthesis sheet (index test: MWST; outcomes: sensitivity and specificity of pharyngeal residue detection)

Outcome	N (n)	Design	Factors that may reduce the quality of evidence					Final quality	Effectiveness per 1000 patients	Importance
			Limitation	Indirectness	Inconsistency	Imprecision	Publication bias			
True positive	1 (17)	Cross-sectional	None	None	None	Serious	None	Low	110	6.3
True negative	1 (74)	Cross-sectional	None	None	None	Serious	None	Low	477	6.3
False positive	1 (41)	Cross-sectional	None	None	None	Serious	None	Low	265	6.3
False negative	1 (23)	Cross-sectional	None	None	None	Serious	None	Low	148	6.3
Uncertain results	No reports	—	—	—	—	—	—	—	—	—

⑧CQ5 Evidence evaluation sheet (index test: FT; outcomes: sensitivity and specificity of aspiration detection)

CQ	CQ5
Patients	18 years old age and older
Index test	FT (Food Test)
Control	N.A.
Reference test	VE or VF

*Risk of bias, indirectness
Each domain will be rated on three levels: 'high risk,' 'low risk,' and 'unknown.
The summary should be reflected in the body of evidence in three levels: 'serious', 'unlikely', and 'none'.

Summarize each outcome on a separate sheet.

Outcome			Sensitivity and specificity in detecting aspiration																						
Studies			Risk of bias*					Indirectness*				Number													
ID	Design	Reference test	Selection bias	Index test	Reference test	Flow and timing	Summary	Patients	Index test	Reference test	Summary	TP	FP	TN	FN	Prevalence	95% CI	Sensitivity	95% CI	Specificity	95% CI	Accuracy	95% CI	ROC AUC	95% CI	P-value
Osawa 2012	Cross-sectional	VF	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	None	8	89	56	2	0.06	0.31, 0.12	0.80	0.44, 0.97	0.39	0.31, 0.47	0.41	0.33, 0.49	NA	NA	NA

⑨CQ5 Evidence synthesis sheet (index test: FT; outcomes: sensitivity and specificity of aspiration detection)

Outcome	N (n)	Design	Factors that may reduce the quality of evidence					Final quality	Effectiveness per 1000 patients	Importance
			Limitation	Indirectness	Inconsistency	Imprecision	Publication bias			
True positive	1 (8)	Cross-sectional	None	None	None	Serious	None	Low	52	6.3
True negative	1 (56)	Cross-sectional	None	None	None	Serious	None	Low	361	6.3
False positive	1 (89)	Cross-sectional	None	None	None	Serious	None	Low	574	6.3
False negative	1 (2)	Cross-sectional	None	None	None	Serious	None	Low	13	6.3
Uncertain results	No reports	—	—	—	—	—	—	—	—	—

(4) CQ 6

①Database search formula

PubMed

#1	Search "Pneumonia, Aspiration"[mh] OR "Deglutition Disorders"[mh]
#2	Search aspiration pneumonia*[tiab] OR deglutition disorder*[tiab] OR dysphagia[tiab]
#3	Search (pharyn*[tiab] OR oropharyn*[tiab]) AND (aspirat*[tiab] OR residue*[tiab])
#4	Search #1 or #2 or #3
#5	Search "Auscultation"[mh] OR "Stethoscopes"[mh] OR auscultation[tiab] OR stethoscope*[tiab]
#6	Search cervical[tiab] OR swallowing sound*[tiab]
#7	Search #4 and #5 and #6

Embase

S1	(EMB.EXACT.EXPLODE("aspiration pneumonia") OR EMB.EXACT.EXPLODE("dysphagia"))
S2	(TI,AB((aspiration NEAR pneumonia*) OR (deglutition NEAR disorder*) OR (swallowing NEAR disorder*) OR dysphagia*))
S3	(TI,AB((pharyn* OR oropharyn*) AND (aspirat* OR residue*)))
S4	(S1 OR S2 OR S3)
S5	(EMB.EXACT("auscultation") OR EMB.EXACT.EXPLODE("stethoscope"))
S6	(TI,AB(auscultation OR stethoscope*))
S7	(S5 or S6)
S8	(TI,AB(cervical OR swallowing P/2 sound*))
S9	(S4 and S7 and S8)

CINAHL

S1	MH "Pneumonia, Aspiration" OR MH "Deglutition Disorders"
S2	aspiration pneumonia OR deglutition disorder* OR dysphagia
S3	(pharyn* OR oropharyn*) AND (aspirat* OR residue*)
S4	S1 OR S2 OR S3
S5	(MH "Auscultation") OR (MH "Stethoscopes")
S6	auscultation OR stethoscope*
S7	S5 OR S6
S8	S4 AND S7

Cochrane Library

#1	MeSH descriptor: ["Pneumonia, Aspiration"] explode all trees
#2	aspiration pneumonia or deglutition disorder* or dysphagia:ti,ab,kw
#3	(pharyn* OR oropharyn*) and (aspiration* or residue*):ti,ab,kw
#4	#1 or #2 or #3
#5	MeSH descriptor: ["Auscultation"] explode all trees
#6	(auscultation OR stethoscope*):ti,ab,kw
#7	#5 or #6
#8	(cervical OR swallowing sound*):ti,ab,kw
#9	#4 and #7 and #8

Ichushi-Web

#1	Pneumonia-Swallowing/TH or Aspiration Pneumonia/AL or Swallowing Pneumonia/AL or Suction Pneumonia/AL (in Japanese)
#2	@Dysphagia/TH or Dysphagia/AL (in Japanese)
#3	(Swallowing/TH or Swallowing/AL) (in Japanese)
#4	(Aspiration/TH or Aspiration/AL in the airway) or Residual/AL (in Japanese)
#5	#3 and #4
#6	#1 or #2 or #5
#7	Auscultation/TH or Auscultation/AL (in Japanese)
#8	Screening/AL or Detection/AL or Inspection/AL or Evaluation/AL (in Japanese)
#9	#6 and #7 and #8

②CQ6 Evidence evaluation sheet (outcomes: sensitivity and specificity of aspiration detection)

CQ	CQ6
Patients	18 years old age and older
Index test	Cervical auscultation
Control	N.A.
Reference test	VE or VF

*Risk of bias, indirectness
Each domain will be rated on three levels: "high risk," "low risk," and "unknown.
The summary should be reflected in the body of evidence in three levels: "serious", "unlikely", and "none".

Summarize each outcome on a separate sheet.

Outcome			Sensitivity and specificity in detecting aspiration																						
Studies			Risk of bias*					Indirectness*				Number													
ID	Design	Reference test	Selection bias	Index test	Reference test	Flow and timing	Summary	Patients	Index test	Reference test	Summary	TP	FP	TN	FN	Prevalence	95% CI	Sensitivity	95% CI	Specificity	95% CI	Accuracy	95% CI	ROC AUC	95% CI	P-value
Shaw 2004 (Respiratory sound)	Cross-sectional	VF	Low risk	Low risk	Low risk	Low risk	None	Low risk	Low risk	Low risk	なし	18	8	57	22	0.38	0.29, 0.48	0.45	0.29, 0.62	0.88	0.77, 0.93	0.71	0.57, 0.76	NA	NA	NA
Inoue 2005, 2007 (Respiratory sound)	Cross-sectional	VF	High risk	Unknown	Low risk	Low risk	Unlikely	High risk	Low risk	Low risk	Unlikely	62	8	30	5	0.64	0.54, 0.73	0.93	0.83, 0.98	0.79	0.63, 0.90	0.88	0.80, 0.93	NA	NA	NA
Sugimoto 2010 (Respiratory sound)	Cross-sectional	VF	Low risk	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	なし	8	0	6	2	0.63	0.35, 0.85	0.80	0.44, 0.97	1.00	0.54, 1.00	0.88	0.62, 0.98	NA	NA	NA
Nozue 2017 (Respiratory sound)	Cross-sectional	VF	Low risk	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	なし	111	165	195	81	0.35	0.31, 0.39	0.58	0.50, 0.64	0.54	0.49, 0.59	0.55	0.51, 0.60	NA	NA	NA
Caviedes 2010 (Respiratory and swallowing sound)	Cross-sectional	VE	Low risk	Low risk	Unknown	Low risk	Unlikely	Low risk	Low risk	Low risk	なし	14	9	37	3	0.27	0.17, 0.40	0.82	0.57, 0.96	0.80	0.66, 0.91	0.81	0.69, 0.90	NA	NA	NA
Boer 2007 (Respiratory and swallowing sound)	Cross-sectional	VF	High risk	Unknown	Low risk	Low risk	Unlikely	High risk	Low risk	Low risk	Unlikely	110	54	126	7	0.39	0.34, 0.45	0.94	0.88, 0.98	0.70	0.63, 0.77	0.79	0.74, 0.84	NA	NA	NA
Nozue 2017 (Respiratory and swallowing sound)	Cross-sectional	VF	Low risk	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	なし	157	191	169	35	0.35	0.31, 0.39	0.82	0.76, 0.87	0.47	0.42, 0.52	0.59	0.55, 0.63	NA	NA	NA
Watanabe, 2006, Olshiige 2012 (Swallowing sound)	Cross-sectional	VF	Low risk	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	なし	18	2	55	15	0.37	0.27, 0.47	0.55	0.36, 0.72	0.96	0.88, 1.00	0.81	0.71, 0.89	NA	NA	NA
Watanabe, 2006, Olshiige 2012 (Respiratory sound)	Cross-sectional	VF	Low risk	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	なし	30	8	49	3	0.37	0.27, 0.47	0.91	0.76, 0.98	0.86	0.74, 0.94	0.88	0.79, 0.94	NA	NA	NA
Santamato 2009 (Swallowing sound)	Cross-sectional	VE	High risk	Low risk	Unknown	Low risk	Unlikely	High risk	Low risk	Low risk	Unlikely	4	0	7	4	0.53	0.27, 0.79	0.50	0.16, 0.84	1.00	0.59, 1.00	0.73	0.45, 0.92	NA	NA	NA
Stroud 2002 (Swallowing sound)	Cross-sectional	VF	Low risk	Low risk	Unknown	Low risk	Unlikely	Low risk	Low risk	Low risk	なし	28	57	73	2	0.19	0.13, 0.26	0.93	0.78, 0.99	0.56	0.47, 0.65	0.63	0.55, 0.71	NA	NA	NA
Leslie 2004 (Swallowing sound)	Cross-sectional	VF	High risk	Low risk	Unknown	Low risk	Unlikely	High risk	Low risk	Low risk	Unlikely	8	1	9	2	0.50	0.27, 0.73	0.80	0.44, 0.97	0.90	0.55, 1.00	0.85	0.62, 0.97	NA	NA	NA
Nozue 2017 (Swallowing sound)	Cross-sectional	VF	Low risk	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	なし	139	181	179	53	0.35	0.31, 0.39	0.72	0.65, 0.79	0.50	0.44, 0.55	0.58	0.53, 0.62	NA	NA	NA

*Shaded cells were excluded from the meta-analysis due to duplication
*1 If healthy subjects were included in the study, they were evaluated high risk for selection bias and high risk for indirectmesty
*2 Blinding unknown, but if the order is stated, the first test is low risk and the later tests cannot be said to be unaffected, so it is assumed to be unknown.
*3 Boor 2007, Leslie 2004, Nozue 2017 detect penetration and aspiration together as "abnormal".
*4 Nozue 2017 had another cervical auscultation 3 weeks later to measure the accuracy of both. There was no significant difference between the first and second time, and only the results of the first time are shown in the table.
*5Boor 2007 tested the same subject 9 times, Stroud 2002 tested the same subject 10 times, and Nozue 2017 tested the same subject 12 times. TP and other values are listed as sums.
*6. In Boor 2007, the evaluation by STs, students, and the general public were described, but there was no significant difference and only the evaluation by STs is described in the table.

③CQ6 Evidence synthesis sheet (outcomes: sensitivity and specificity of aspiration detection)

Outcome	N (n)	Design	Factors that may reduce the quality of evidence					Final quality	Effectiveness per 1000 patients	Importance
			Limitation	Indirectness	Inconsistency	Imprecision	Publication bias			
True positive	10 (439)	Cross-sectional	Unlikely	Unlikely	Unlikely	None	Unlikely	Low	309	6.3
True negative	10 (563)	Cross-sectional	Unlikely	Unlikely	Unlikely	None	Unlikely	Low	396	6.3
False positive	10 (336)	Cross-sectional	Unlikely	Unlikely	Unlikely	None	Unlikely	Low	236	6.3
False negative	10 (85)	Cross-sectional	Unlikely	Unlikely	Unlikely	None	Unlikely	Low	60	6.3
Uncertain results	No reports	—	–	–	–	–	–	–	–	–

④CQ6 Evidence evaluation sheet (outcomes: sensitivity and specificity of pharyngeal residue detection)

CQ	CQ6
Patients	18 years old age and older
Index test	Cervical auscultation
Control	N.A.
Reference test	VE or VF

*Risk of bias, indirectness
Each domain will be rated on three levels: "high risk," "low risk," and "unknown.
The summary should be reflected in the body of evidence in three levels: "serious", "unlikely", and "none".

Summarize each outcome on a separate sheet.

Outcome			Accuracy in detecting pharyngeal residue in the pyriform fossa and epiglottic valley																						
Studies			Risk of bias*					Indirectness*				Number													
ID	Design	Reference test	Selection bias	Index test	Reference test	Flow and timing	Summary	Patients	Index test	Reference test	Summary	TP	FP	TN	FN	Prevalence	95% CI	Sensitivity	95% CI	Specificity	95% CI	Accuracy	95% CI	ROC AUC	95% CI	P-value
Tamura 2008 (Respiratory sound)	Cross-sectional	VF	Low risk	Unknown	Unknown	Low risk	Unlikely	Low risk	Low risk	Low risk	None	3	1	2	2	0.63	0.24, 0.91	0.60	0.15, 0.95	0.67	0.09, 0.99	0.63	0.24, 0.91	NA	NA	NA

⑤CQ6 Evidence synthesis sheet (outcomes: sensitivity and specificity of pharyngeal residue detection)

Outcome	N (n)	Design	Factors that may reduce the quality of evidence					Final quality	Effectiveness per 1000 patients	Importance
			Limitation	Indirectness	Inconsistency	Imprecision	Publication bias			
True positive	1 (3)	Cross-sectional	Unlikely	None	None	Serious	None	Very low	375	6.3
True negative	1 (2)	Cross-sectional	Unlikely	None	None	Serious	None	Very low	250	6.3
False positive	1 (1)	Cross-sectional	Unlikely	None	None	Serious	None	Very low	125	6.3
False negative	1 (2)	Cross-sectional	Unlikely	None	None	Serious	None	Very low	250	6.3
Uncertain results	No reports	—	—	—	—	—	—	—	—	—

(5) CQ 7

①Database search formula

PubMed

#1	Search "Pneumonia, Aspiration"[mh] OR "Deglutition Disorders"[mh]
#2	Search aspiration pneumonia*[tiab] OR deglutition disorder*[tiab] OR dysphagia[tiab]
#3	Search #1 or #2
#4	Search "Ultrasonography"[mh]
#5	Search ultrason*[tiab] OR ultrasound*[tiab] OR echotomograph*[tiab] OR echo tomograph*[tiab] OR echograph*[tiab] OR sonograph*[tiab] OR ultra sound*[tiab]
#6	Search #4 or #5
#7	Search screening[tiab] OR predict*[tiab] OR test[tiab] OR tests[tiab] OR detect*[tiab] OR assess*[tiab] OR evaluat*[tiab]
#8	Search deglutit*[tiab] OR swallow*[tiab] OR esophag*[tiab] OR pharyn*[tiab] OR oropharyn*[tiab]
#9	Search #3 and #6 and #7 and #8

Embase

S1	((EMB.EXACT.EXPLODE("aspiration pneumonia") OR EMB.EXACT.EXPLODE("dysphagia")))
S2	((TI,AB((aspiration NEAR pneumonia*) OR (deglutition NEAR disorder*) OR (swallowing NEAR disorder*) OR dysphagia*)))
S3	(S1 OR S2)
S4	EMB.EXACT.EXPLODE("echography")
S5	(TI,AB(ultrason* OR ultrasound* OR echotomograph* OR (echo PRE/2 tomograph*) OR echograph* OR sonograph* OR (ultra PRE/2 sound)))
S6	(S4 OR S5)
S7	(TI,AB(deglutit* OR swallow* OR dysphagia* OR esophag* OR pharyn* OR oropharyn*))
S8	(TI,AB(screening OR predict* OR test OR tests OR detect* OR assess* OR evaluat*))
S9	((S3 AND S6 AND (S7 NEAR S8)))

CINAHL

S1	MH "Pneumonia, Aspiration" OR MH "Deglutition Disorders"
S2	aspiration pneumonia OR deglutition disorder* OR dysphagia
S3	S1 OR S2
S4	(MH "Ultrasonography+")
S5	ultrason* OR ultrasound* OR echotomograph* OR echo tomograph* OR echograph* OR sonograph* OR ultra sound*
S6	S4 OR S5
S7	screening OR predict* OR test OR tests OR detect* OR assess* OR evaluat*
S8	deglutit* OR swallow* OR esophag* OR pharyn* OR oropharyn*
S9	S3 AND S6 AND S7 AND S8

Cochrane Library

#1	MeSH descriptor: ["Pneumonia, Aspiration"] explode all trees
#2	(aspiration pneumonia or deglutition disorder* or dysphagia):ti,ab,kw
#3	#1 or #2
#4	MeSH descriptor: [Ultrasonography] explode all trees
#5	(ultrason* or ultrasound* or echotomograph* or echo tomograph* or echograph* or sonograph* or ultra sound*):ti,ab,kw
#6	#4 or #5
#7	((deglutit* OR swallow* OR dysphagia* OR esophag* OR pharyn* OR oropharyn*) near/5 (screening OR predict* OR test OR tests OR detect* OR assess* OR evaluat*)):ti,ab,kw
#8	#3 and #6 and #7

Ichushi-Web

#1	Pneumonia-Swallowing/TH or Aspiration Pneumonia/AL or Swallowing Pneumonia/AL or Suction Pneumonia/AL (in Japanese)
#2	@Dysphagia/TH or Dysphagia/AL (in Japanese)
#3	(Swallowing/TH or Swallowing/AL) (in Japanese)
#4	(Aspiration/TH or Aspiration/AL in the airway) or Residual/AL (in Japanese)
#5	#3 and #4
#6	#1 or #2 or #5
#7	Screening/AL or screening/AL or detection/AL or testing/AL or evaluation/AL (in Japanese)
#8	(Ultrasound/TH or Ultrasound/AL) (in Japanese)
#9	#6 and #7 and #8

②CQ7 Evidence evaluation sheet (outcomes: sensitivity and specificity of aspiration detection)

CQ	CQ7
Patients	18 years old age and older
Index test	Screening for eating and swallowing disorders by observation with ultrasound diagnostic device
Control	N.A.
Reference test	VE or VF

*Risk of bias, indirectness
Each domain will be rated on three levels: "high risk," "low risk," and "unknown.
The summary should be reflected in the body of evidence in three levels: "serious", "unlikely", and "none".

Summarize each outcome on a separate sheet.

Outcome			Sensitivity and specificity in detecting aspiration																						
Studies			Risk of bias*					Indirectness*				Number													
ID	Design	Reference test	Selection bias	Index test	Reference test	Flow and timing	Summary	Patients	Index test	Reference test	Summary	TP	FP	TN	FN	Prevalence	95% CI	Sensitivity	95% CI	Specificity	95% CI	Accuracy	95% CI	ROC AUC	95% CI	P-value
Miura 2014b	Cross-sectional	VE/ VF	Unknown	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	10	2	29	1	0.26	0.14, 0.42	0.91	0.59, 1.00	0.94	0.79, 0.99	0.93	0.81, 0.99	NA	NA	NA
Miura 2014a	Cross-sectional	VE/ VF	Unknown	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	7	5	26	4	0.26	0.14, 0.42	0.64	0.31, 0.89	0.84	0.66, 0.95	0.79	0.63, 0.90	NA	NA	NA
Tomii 2011	Cross-sectional	VF	Unknown	Unknown	Unknown	Unknown	Unlikely	Low risk	Low risk	Low risk	None	20	9	67	4	0.24	0.20, 0.39	0.83	0.63, 0.95	0.88	0.79, 0.94	0.87	0.79, 0.93	NA	NA	NA
Lee 2016_hbd	Cross-sectional	VF	Unknown	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	26	4	17	5	0.60	0.45, 0.73	0.84	0.66, 0.95	0.81	0.58, 0.95	0.83	0.70, 0.92	NA	NA	NA
Lee 2016_delta	Cross-sectional	VF	Unknown	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	20	1	20	11	0.60	0.45, 0.73	0.65	0.45, 0.81	0.95	0.76, 1.00	0.77	0.63, 0.87	NA	NA	NA

*1. Lee 2016 included laryngeal invasion. Accuracy is described both using hyoid bone displacement and delta value. The meta-analysis uses the evaluation using hyoid bone displacement.

③CQ7 Evidence synthesis sheet (outcomes: sensitivity and specificity of aspiration detection)

Outcome	N (n)	Design	Factors that may reduce the quality of evidence					Final quality	Effectiveness per 1000 patients	Importance
			Limitation	Indirectness	Inconsistency	Imprecision	Publication bias			
True positive	4 (63)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	267	6.3
True negative	4 (139)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	589	6.3
False positive	4 (20)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	85	6.3
False negative	4 (14)	Cross-sectional	Unlikely	None	Unlikely	None	Unlikely	Low	59	6.3
Uncertain results	No reports	—	—	—	—	—	—	—	—	—

④CQ7 Evidence evaluation sheet (outcomes: sensitivity and specificity of pharyngeal residue detection)

CQ	CQ7
Patients	18 years old age and older
Index test	Screening for eating and swallowing disorders by observation with ultrasound diagnostic device
Control	N.A.
Reference test	VE or VF

*Risk of bias, indirectness
Each domain will be rated on three levels: "high risk," "low risk," and "unknown.
The summary should be reflected in the body of evidence in three levels: "serious", "unlikely", and "none".

Summarize each outcome on a separate sheet.

Outcome			Sensitivity and specificity in detecting pharyngeal residue																						
Studies			Risk of bias*					Indirectness*				Number													
ID	Design	Reference test	Selection bias	Index test	Reference test	Flow and timing	Summary	Patients	Index test	Reference test	Summary	TP	FP	TN	FN	Prevalence	95% CI	Sensitivity	95% CI	Specificity	95% CI	Accuracy	95% CI	ROC AUC	95% CI	P-value
Miura 2016	Cross-sectional	VE	Unknown	Unknown	Low risk	Low risk	Unlikely	Low risk	Low risk	Low risk	None	8	2	4	5	0.68	0.43, 0.87	0.62	0.32, 0.86	0.67	0.22, 0.96	0.63	0.38, 0.84	NA	NA	NA

⑤CQ7 Evidence synthesis sheet (outcomes: sensitivity and specificity of pharyngeal residue detection)

Outcome	N (n)	Design	Factors that may reduce the quality of evidence					Final quality	Effectiveness per 1000 patients	Importance
			Limitation	Indirectness	Inconsistency	Imprecision	Publication bias			
True positive	1 (8)	Cross-sectional	Unlikely	None	None	Serious	None	Very low	421	6.3
True negative	1 (4)	Cross-sectional	Unlikely	None	None	Serious	None	Very low	211	6.3
False positive	1 (2)	Cross-sectional	Unlikely	None	None	Serious	None	Very low	105	6.3
False negative	1 (5)	Cross-sectional	Unlikely	None	None	Serious	None	Very low	263	6.3
Uncertain results	No reports	–	–	–	–	–	–	–	–	–

(6) CQ 8

①Database search formula

PubMed

#1	"Pneumonia, Aspiration"[mh] OR "Deglutition Disorders"[mh]
#2	aspiration pneumonia*[tiab] OR deglutition disorder*[tiab] OR dysphagia[tiab]
#3	aspiration*[tiab] OR residue*[tiab]
#4	#1 or #2 or #3
#5	deglutit*[tiab] OR swallow*[tiab]
#6	care[tiab] OR ("nursing"[sh] OR "nursing"[mh]) OR ("rehabilitation"[sh] OR "rehabilitation"[tiab] OR "rehabilitation"[mh]) OR exercise*[tiab] OR training[tiab]
#7	"Ultrasonography"[mh]
#8	ultrason*[tiab] OR ultrasound*[tiab] OR echotomograph*[tiab] OR echo tomograph*[tiab] OR echograph*[tiab] OR sonograph*[tiab] OR ultra sound[tiab] OR acoustic[tiab]
#9	#7 or #8
#10	#4 and #5 and #6 and #9

Embase

S1	(EMB.EXACT.EXPLODE("aspiration pneumonia") OR EMB.EXACT.EXPLODE("dysphagia"))
S2	(TI,AB((aspiration NEAR pneumonia*) OR (deglutition NEAR disorder*) OR (swallowing NEAR disorder*) OR dysphagia*))
S3	(TI,AB(aspiration* OR residue*))
S4	(S1 or S2 or S3)
S5	(TI,AB(deglutit* OR swallow*) AND QU(RH))
S6	(TI,AB((deglutit* OR swallow*) NEAR (care OR management OR rehabilitation OR exercise* OR training)))
S7	(S5 or S6)
S8	EMB.EXACT.EXPLODE("echography")
S9	(TI,AB(ultrason* OR ultrasound* OR echotomograph* OR (echo PRE/2 tomograph*) OR echograph* OR sonograph* OR (ultra PRE/2 sound) OR acoustic))
S10	(S8 or S9)
S11	(S4 and S7 and S10)

CINAHL

S1	MH "Pneumonia, Aspiration" OR MH "Deglutition Disorders"
S2	aspiration pneumonia OR deglutition disorder* OR dysphagia
S3	aspiration* OR residue*
S4	S1 OR S2 OR S3
S5	(deglutit* OR swallow*) AND (MW "NU" OR MW "RH")
S6	(deglutit* OR swallow*) N5 (care OR management OR rehabilitation OR exercise* OR training)
S7	S5 OR S6
S8	MH Ultrasonography+
S9	ultrason* OR ultrasound* OR echotomograph* OR echo tomograph* OR echograph* OR sonograph* OR ultra sound* OR acoustic
S10	S8 OR S9
S11	S4 AND S7 AND S10

Cochrane Library

#1	[mh "Pneumonia, Aspiration"] or [mh "Deglutition Disorders"]
#2	aspiration pneumonia or deglutition disorder* or dysphagia:ti,ab,kw
#3	aspiration* or residue*:ti,ab,kw
#4	#1 or #2 or #3
#5	((deglutit* or swallow*) near/5 (care or management or rehabilitation or exercise* or training)):ti,ab,kw
#6	[mh Ultrasonography]
#7	(ultrason* or ultrasound* or echotomograph* or echo tomograph* or echograph* or sonograph* or ultra sound* or acoustic):ti,ab,kw
#8	#6 or #7
#9	#4 and #5 and #8

Ichushi-Web

#1	Pneumonia-Swallowing/TH or Aspiration Pneumonia/AL or Swallowing Pneumonia/AL or Suction Pneumonia/AL (in Japanese)
#2	@Dysphagia/TH or Dysphagia/AL (in Japanese)
#3	(Swallowing/TH or Swallowing/AL) (in Japanese)
#4	(Aspiration/TH or Aspiration/AL in the airway) or Residual/AL (in Japanese)
#5	#3 and #4
#6	#1 or #2 or #5
#7	Swallowing Care/AL or Swallowing Training/TH or Swallowing Training/AL or Swallowing Rehab/AL or Swallowing Support/AL or Swallowing Assistance/AL (in Japanese)
#8	(Ultrasound/TH or Ultrasound/AL) (in Japanese)
#9	#6 and #7 and #8

②CQ8 Evidence appraisal sheet (outcome: incidence of aspiration pneumonia)

CQ	CQ8
Patients	18 years old age and older
Intervention	Management of oropharyngeal dysphagia based on ultrasound observations
Control	Conventional management of oropharyngeal dysphagia based on conventional observation

* Each item is rated on a scale of "high (-2)", "moderate/doubt (-1)", and "low (0)".
The summary should be reflected in the total evidence on three levels: "high (-2)," "moderate (-1)," and "low (0).

Summarize on a separate sheet for each outcome

Outcome		Incidence of aspiration pneumonia																							
Studies		Risk of bias*										Indirectness*					Number at risk (outcome rate)								
		Selection bias		Exection bias	Detection bias	Case reduction bias	Others																		
ID	Design	Randomization	Concealment	Blind	Blind	ITT	Incomplete outcome reporting	Selective outcome reporting	Early study discontinuation	Other bias	Sumarry	Patients	Intervin	Control	Outcome	Sumarry	Control goup denominator	Control goup numerator	(%)	Intervein goup denominator	Intervention goup numerator	(%)	Effectiveness index (type)	Effectiveness index (value)	95% CI
Miura 2018	RCT	0	0	−2	−2	−2	0	0	0	0	0	−1	0	0	0	−1	23	1	4.3	23	2	8.7	OR	2.09	0.18, 24.87

③CQ8 Evidence evaluation sheet (outcome: incidence of aspiration)

CQ	CQ8
Patients	18 years old age and older with suspected dysphagia
Intervention	Management of oropharyngeal dysphagia based on physical assessment techniques
Control	Conventional management of oropharyngeal dysphagia based on conventional observation

* Each item is rated on a scale of "high (-2)", "moderate/doubt (-1)", and "low (0)".
The summary should be reflected in the total evidence on three levels: "high (-2)," "moderate (-1)," and "low (0).

Summarize on a separate sheet for each outcome

Outcome		Incidence of aspiration																							
Studies		Risk of bias*										Indirectness*					Number at risk (outcome rate)								
		Selection bias		Exection bias	Detection bias	Case reduction bias	Others																		
ID	Design	Randomization	Concealment	Blind	Blind	ITT	Incomplete outcome reporting	Selective outcome reporting	Early study discontinuation	Other bias	Sumarry	Patients	Intervin	Control	Outcome	Sumarry	Control goup denominator	Control goup numerator	(%)	Intervein goup denominator	Intervention goup numerator	(%)	Effectiveness index (type)	Effectiveness index (value)	95% CI
Miura 2018	RCT	0	0	−2	−2	−2	0	0	0	0	0	−1	0	0	0	−1	23	3	13.0	23	1	4.3	OR	0.30	0.03, 3.15

④CQ8 Evidence evaluation sheet (outcome: incidence of pharyngeal residue in the pyriform fossa)

CQ	CQ8
Patients	18 years old age and older
Intervention	Management of oropharyngeal dysphagia based on ultrasound observations
Control	Conventional management of oropharyngeal dysphagia based on conventional observation

* Each item is rated on a scale of "high (-2)", "moderate/doubt (-1)", and "low (0)".
The summary should be reflected in the total evidence on three levels: "high (-2)," "moderate (-1)," and "low (0).

Summarize on a separate sheet for each outcome

Outcome		Incidence of pharyngeal residue in the pyriform fossa																							
Studies		Risk of bias*										Indirectness*					Number at risk (outcome rate)								
		Selection bias		Exection bias	Detection bias	Case reduction bias	Others																		
ID	Design	Randomization	Concealment	Blind	Blind	ITT	Incomplete outcome reporting	Selective outcome reporting	Early study discontinuation	Other bias	Sumarry	Patients	Intervin	Control	Outcome	Sumarry	Control goup denominator	Control goup numerator	(%)	Intervein goup denominator	Intervention goup numerator	(%)	Effectiveness index (type)	Effectiveness index (value)	95% CI
Miura 2018	RCT	0	0	−2	−2	−2	0	0	0	0	0	−1	0	0	0	−1	23	3	13.0	23	2	8.7	OR	0.63	0.10, 4.2

⑤CQ8 Evidence synthesis sheet

CQ	CQ8
Patients	18 years old age and older
Intervention	Management of oropharyngeal dysphagia based on ultrasound observations
Control	Conventional management of oropharyngeal dysphagia based on conventional observation

The strength of evidence starts from "strong (A)" for RCTs and from "weak (C)" for observational studies.
* Each domain has three levels: "high (-2)," "moderate/doubtful (-1)," and "low (0).
** Four levels of evidence strength: "strong (A)," "moderate (B)," "weak (C)," and "very weak (D)."
*** Importance is the importance of the outcome (1-9)

Body of evidence

Outcome	Design/ N	Risk of bias*	Inconsistency*	Imprecision*	Indirectness*	Others (publication bias, etc.)*	Factors of upgrade (Observational study)*	Number at risk (outcome rate)						Effectiveness index (type)	Effectiveness index (value)	95% CI	Strength of evidence**	Importance***	Comments
								Control group denominator	Control group numerator	(%)	Intervention group denominator	Intervention group numerator	(%)						
Incidence of aspiration pneumonia	RCT/1	0	0	−2	−1	0		23	1	4.3	23	2	8.7	OR	2.09	0.18, 24.8	⊕⊕ (C)	9	
Incidence of aspiration	RCT/1	0	0	−1	−1	0		23	3	13.0	23	1	4.3	OR	0.30	0.03, 3.15	⊕⊕ (C)	8	Miura's study assessed the increase or decrease in incidence after 8 weeks compared to baseline. In the present study, we evaluated the actual number of cases after 8 weeks. In other words, if there was even one aspiration or residual after 8 weeks, it was included in the number of patients.
Incidence of pyaryngeal residue in the pyriform fossa	RCT/1	0	0	−1	−1	0		23	3	13.0	23	2	8.7	OR	0.63	0.10, 4.21	⊕⊕ (C)	7	Miura's study assessed the increase or decrease in incidence after 8 weeks compared to baseline. In the present study, we evaluated the actual number of cases after 8 weeks. In other words, if there was even one aspiration or residual after 8 weeks, it was included in the number of patients.

(7) CQ 9

①Database search formula

PubMed

#1	Search "Pneumonia, Aspiration/diagnosis"[mh] OR "Deglutition Disorders/diagnosis"[mh]
#2	Search "Endoscopy"[mh]
#3	Search endoscop* [tiab]
#4	Search #2 or #3
#5	Search #1 and #4
#6	Search (endoscopic evaluation[tiab] OR endoscopic assessment[tiab] OR fiberendoscopic evaluation[tiab]) AND swallowing[tiab]
#7	Search #5 or #6
#8	Search "Observer Variation"[mh]
#9	Search agreement* [tiab] OR concordance[tiab]
#10	Search intra-rater[tiab] OR intrarater[tiab] OR inter-rater[tiab] OR interrater[tiab]
#11	Search #8 or #9 or #10
#12	Search #7 and #11

Embase

S1	(EMB.EXACT.EXPLODE("aspiration pneumonia -- diagnosis")) OR (EMB.EXACT.EXPLODE("dysphagia -- diagnosis"))
S2	EMB.EXACT.EXPLODE("endoscopy")
S3	TI,AB(endoscop*)
S4	(S2 or S3)
S5	(S1 and S4)
S6	(TI,AB(((endoscopic OR fiberendoscopic) N/2 (evaluation OR assessment)) N/2 swallowing))
S7	(S5 or S6)
S8	(EMB.EXACT.EXPLODE("observer variation"))
S9	(TI,AB(agreement* OR concordance))
S10	(TI,AB("intra-rater" OR intrarater OR "inter-rater" OR interrater))
S11	(S8 or S9 or S10)
S12	(S7 and S11)

CINAHL

S1	MH "Pneumonia, Aspiration/DI" OR MH "Deglutition Disorders/DI"
S2	MH "Endoscopy+"
S3	endoscop*
S4	S2 OR S3
S5	S1 AND S4
S6	(((endoscopic OR fiberendoscopic) N2 (evaluation OR assessment)) N2 swallowing
S7	S5 OR S6
S8	"Observer Variation"
S9	agreement* OR concordance
S10	("intra-rater" OR intrarater OR "inter-rater" OR interrater)
S11	S8 OR S9 OR S10
S12	S7 AND S11

Cochrane Library

#1	[mh "Pneumonia, Aspiration"/DI] OR [mh "Deglutition Disorders"/DI]
#2	[mh Endoscopy] OR endoscop*:ti,ab,kw
#3	#1 and #2
#4	(((endoscopic OR fiberendoscopic) NEAR/2 (evaluation OR assessment)) NEAR/2 swallowing):ti,ab,kw
#5	#3 or #4
#6	[mh "Observer Variation"]
#7	(agreement* OR concordance):ti,ab,kw
#8	("intra-rater" OR intrarater OR "inter-rater" OR interrater):ti,ab,kw
#9	#6 or #7 or #8
#10	#5 and #9
#11	#5 and #9 in Cochrane Reviews, Cochrane Protocols
#12	#5 and #9 in Trials

Ichushi-Web

#1	Pneumonia-aspirated/TH or aspiration pneumonia/AL or swallowed pneumonia/AL or attracted pneumonia/AL (in Japanese)
#2	@Dysphagia/TH or Dysphagia/AL (in Japanese)
#3	Swallowing/AL or Aspiration/AL (in Japanese)
#4	#1 or #2 or #3
#5	Endoscopy/TH or Endoscopy/AL (in Japanese)
#6	Consistency/AL or Degree of Consistency/AL or Inconsistency/AL or Inconsistent/AL or Inconsistent Not/AL (in Japanese)
#7	Difference by observer/TH (in Japanese)
#8	between examiners/AL or within examiners/AL or between raters/AL or within raters/AL or between raters/AL or within raters/AL or between observers/AL or within observers/AL (in Japanese)
#9	#6 or #7 or #8
#10	#4 and #5 and #9

(8) CQ 10

①Database search formula

PubMed

#1	Search "Pneumonia, Aspiration"[mh] OR "Deglutition Disorders"[mh]
#2	Search aspiration pneumonia* [tiab] OR deglutition disorder* [tiab] OR dysphagia[tiab]
#3	Search aspirat* [tiab] OR residu* [tiab] OR deglutit* [tiab] OR swallow* [tiab]
#4	Search #1 and #2 or #3
#5	Search "Advanced Practice Nursing"[mh] OR "Nurse's Role"[mh] OR "Nurse Practitioners"[mh] OR "Nurse Specialists"[mh] OR "Education, Nursing"[mh]
#6	Search trained nurse* [tiab]
#7	Search speech-language* [tiab]
#8	Search #5 or #6 or #7
#9	Search endoscop* [tiab]
#10	Search #8 and #9
#11	Search "Endoscopy/nursing"[mh]
#12	Search nurse endoscopist* [tiab] OR nurse-performed endoscop* [tiab] OR non-physician endoscop* [tiab] OR endoscopy nurs* [tiab]
#13	Search #10 or #11 or #12
#14	Search #4 and #13

Embase

S1	((EMB.EXACT.EXPLODE("aspiration pneumonia") OR EMB.EXACT.EXPLODE("dysphagia")))
S2	((TI,AB((aspiration N/2 pneumonia*) OR (deglutition N/2 disorder*) OR (swallowing N/2 disorder*) OR dysphagia*)))
S3	(TI,AB(aspirat* OR residu* OR deglutit* OR swallow*))
S4	(S1 or S2 or S3)
S5	(EMB.EXACT.EXPLODE("advanced practice nursing") OR EMB.EXACT.EXPLODE("nurse practitioner") OR EMB.EXACT.EXPLODE("nursing education") OR EMB.EXACT.EXPLODE("nurse training") OR EMB.EXACT.EXPLODE("nurse specialist"))
S6	(TI,AB((trained N/2 nurse*) OR (speech P/1 language*)))
S7	(S5 or S6)
S8	TI,AB(endoscop*)
S9	(S7 and S8)
S10	(TI,AB((nurse* N/2 endoscopist*) OR ("nurse-performed" N/2 endoscop*) OR (("non-physician" OR nonphysician*) N/2 endoscop*) OR (endoscopy N/2 nurs*)))
S11	(S9 or S10)
S12	(S4 and S11)

CINAHL

S1	MH "Pneumonia, Aspiration" OR MH "Deglutition Disorders"
S2	(aspiration N2 pneumonia*) OR (deglutition N2 disorder*) OR dysphagia*
S3	aspirat* OR residu* OR deglutit* OR swallow*
S4	S1 OR S2 OR S3
S5	MH "Advanced Practice Nursing" OR MH "Nurse's Role" OR MH "Nurse Practitioners" OR MH "Nurse Specialists" OR MH "Education, Nursing"
S6	(trained N2 nurse*) OR (speech W1 language*)
S7	S5 OR S6
S8	endoscop*
S9	S7 AND S8
S10	(MH "Endoscopy+/NU")
S11	(nurse N2 endoscopist*) OR ("nurse-performed" N2 endoscop*) OR (("non-physician" OR nonphysician*) N2 endoscop*) OR (endoscopy N2 nurs*)
S12	S9 OR S10 OR S11
S13	S4 AND S12

Cochrane Library

#1	[mh "Pneumonia, Aspiration"] OR [mh "Deglutition Disorders"]
#2	((aspiration NEAR/2 pneumonia*) OR (deglutition NEAR/2 disorder*) OR dysphagia*):ti,ab,kw
#3	(aspirat* OR residu* OR deglutit* OR swallow*):ti,ab,kw
#4	#1 or #2 or #3
#5	[mh "Advanced Practice Nursing"] OR [mh "Nurse's Role"] OR [mh "Nurse Practitioners"] OR [mh "Nurse Specialists"] OR [mh "Education, Nursing"]
#6	((trained NEAR/2 nurse*) OR (speech NEXT language*)):ti,ab,kw
#7	#5 or #6
#8	endoscop*:ti,ab,kw
#9	#7 and #8
#10	[mh Endoscopy/NU]
#11	((nurse NEAR/2 endoscopist*) OR ("nurse-performed" NEAR/2 endoscop*) OR (("non-physician" OR nonphysician*) NEAR/2 endoscop*) OR (endoscopy NEAR/2 nurs*)):ti,ab,kw
#12	#9 or #10 or #11
#13	#4 and #12
#14	#4 and #12 in Cochrane Reviews, Cochrane Protocols
#15	#4 and #12 in Trials

Ichushi-Web

#1	Pneumonia-aspirated/TH or aspiration pneumonia/AL or swallowed pneumonia/AL or attracted pneumonia/AL (in Japanese)
#2	@Dysphagia/TH or Dysphagia/AL (in Japanese)
#3	Swallowing/AL or Aspiration/AL (in Japanese)
#4	#1 or #2 or #3
#5	Advanced Professional Nursing Practice/TH or Nurse Practitioner/TH or Professional Nurse/TH or Nursing Education/TH or Role of the Nursing Profession/TH (in Japanese)
#6	Articulation Language/AL (in Japanese)
#7	#5 or #6
#8	Endoscopy/TH or Endoscopy/AL (in Japanese)
#9	#7 and #8
#10	(Endoscopy/TH) and (SH=Nursing) (in Japanese)
#11	Endoscopy Nursing/AL (in Japanese)
#12	#9 or #10 or #11
#13	#4 and #12

3. The Conflict of Interest Statuses of the Clinical Guideline Formulators

	Name (Organization)	Economic COI	Academic COI
Supervisory Committee members	Junko Sugama (Fujita Health University)	None	None
	Eiichi Saitoh (Fujita Health University)	None	None
	Erika Ota (St. Luke's International University)	None	None
	Hiromi Sanada (The University of Tokyo)	None	None
	Masako Yamada (St. Luke's International University)	None	None
	Miyuki Ishibashi (Chiba University)	None	None
	Takeshi Nomura (Tokyo Women's Medical University)	None	None
	Takeo Nakayama (Kyoto University)	None	Related clinical guideline preparation members, : Japan Council for Quality Health Care Minds Steering Committee Chair, Japanese Association of Medical Sciences Association Medical Guideline Review Committee, Japanese Society of Neurology Guidelines Supervisor, Japanese Society of Palliative Medicine Guidelines Supervisor, Japan Endoscopic Surgery Society Guidelines Supervisor Committee member
	Yayoi Kamakura (Japanese Red Cross Toyota College of Nursing)	None	None
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	Junko Fukada (Aichi Prefectural University)	None	None
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	Seiko Shibata (Fujita Health University)	None	None
	Takashi Hase (Noto General Hospital)	None	None
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	Itoko Tobita (Jikei University of Health Care Sciences)	None	None
	Kanae Mukai (Kanazawa University)	None	None
	Masaru Matsumoto (The University of Tokyo)	Endowed chairs (affiliations): From April 2017 to the present : Social cooperation course (Investor: FUJIFILM Corporation)	None
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