

Screening Tests in Evaluating Swallowing Function

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Abstract

Diagnosis of dysphagia begins with suspecting its presence. When dysphagia is suspected, patients with high risk should be screened by means of simplified examinations for dysphagia. Many of these screening tests are relatively easy to perform and provide a rough picture of the swallowing condition.

Needless to say, videofluorography and video endoscopic examination of swallowing are the gold standards. On the other hand, highly sensitive, simple screening tests that lead to these examinations are extremely useful when examining general outpatients, inpatients at the bedside, and in-home patients.

Key words Dysphagia, Screening, Aspiration

Introduction

Swallowing movement is intended not only to obtain nourishment but also to protect the respiratory tract. It is therefore important to understand dysphagia as a respiratory disorder when discussing dysphagia. We must be always aware of the possibility that severe dysphagia patients may develop respiratory disorder at any time, such as suffocation or pneumonia.

Screening tests for dysphagia are intended to select the patients who are strongly suspected of dysphagia. Needless to say, videofluorography and video endoscopic examination of swallowing are the gold standards. However, highly sensitive, simple screening tests that lead to these examinations are useful when examining general outpatients, inpatients at the bedside, and patients in in-home care.

This paper mainly describes the screening tests performed by the authors on a routine basis.

Choking and Aspiration

Although aspiration is not present in all patients with dysphagia, it is the most important symptom associated with dysphagia. During early stages of dysphagia, choking caused by aspiration is a conspicuous symptom that can be noticed objectively. However, due attention must be paid since aspiration is not always associated with choking, as described at the end of this section.

If choking or coughing occurs in association with eating, one must assess the timing of the symptom during a meal or swallowing, the frequency, patient's postures, and the variations on the form of food, either through thorough interviews or by observing during meals.

Choking is a protective reflex induced by the entry of a food bolus (foreign matter) into the trachea. It is experienced by anyone in some circumstances, and in itself is not a pathological movement. However, since choking obviously indicates entry of foreign matter into the lower respiratory tract, frequent choking provides a

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Table 1 Criteria for assessing the patients with high risk of dysphagia

<ul style="list-style-type: none"> • Positive results of screening tests • Choking while eating, or prolonged coughing after eating • Persistent malnutrition or dehydration • Presence of wet hoarseness • Has a tracheostomy tube • The trunk support is poor and cannot maintain a sitting position for long • Presence of a high lesion in the brain stem or bilateral high lesions due to cerebrovascular disease • Has chronic respiratory disease • Presence of gastroesophageal reflux • Poor oral care, or ill-fitting dentures • Taking psychotropics or other drugs that may affect swallowing • Being 65 years of age or older
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basis for suspecting dysphagia. At the same time, the fact that the severity of choking (or coughing) does not relate to the severity of dysphagia should be noted.

While choking does suggest aspiration, an absence of choking does not suggest an absence of aspiration. If the lower respiratory tract has developed hypoesthesia after long-term aspiration or due to other conditions, or if protective reflex of the respiratory tract has been reduced or lost, entry of foreign matter into the respiratory tract may not induce choking. This is so-called silent aspiration, which we believe is more serious in terms of the degree of dysphagia.¹

Procedures for Simple Screening Tests

As would be the case with any other pathological condition, an approach to dysphagia begins with suspecting its presence. The diagnostic procedure for dysphagia starts from collecting patient information through history-taking, visual examination, palpation, etc. Patients suspected of having dysphagia proceed to the screening tests listed below. Based on test results, high-risk patients who are reasonably suspected of having dysphagia are screened, and if necessary, these patients proceed to more thorough examination such as videofluorography or video endoscopic examination of swallowing. **Table 1** shows the list of criteria for selecting patients with high risk of dysphagia, used by the authors.

We otorhinolaryngologists often use a laryngeal endoscope during examination in general practice, which allows monitoring of swallowing

movement. Below, we describe 6 screening methods that use no endoscope, which are therefore available to physicians of other specialties or speech therapists. When using any of the following methods in practice, one should make a comprehensive judgment without insisting on any one particular method.

Dry swallowing

Humans repeat swallowing at certain intervals in order to dispose of saliva in the mouth, even when not eating. This dry swallowing is the basic movement used to dispose of saliva. It is therefore necessary to check if the patient can swallow well before conducting any other screening tests.²

Repetitive saliva swallowing test (RSST)³

This test is intended to check the patient's ability to voluntarily swallow repeatedly, which is highly correlated with aspiration. The RSST is simple and also relatively safe to conduct.

Place the patient in a resting position, and wet the inside of the patient's mouth with cold water. Instruct him/her to repeatedly swallow air, and monitor the number of swallows achieved. Three or more dry swallows within 30 seconds is considered normal. The number of swallows is counted by the movement of laryngeal elevation, either visually or by palpating.

Water swallow test

Water is difficult to swallow for patients with dysphagia, especially in patients with static dysphagia with poor food transport function due to cerebrovascular or neuromuscular disease. This

Table 2 Procedure for water swallow tests

<p>Water swallow test (original version)</p> <p>[Procedure] The patient is asked to sit in a chair, and is handed a cup containing 30 mL of water at normal temperature. The patient is then asked to "Please drink this water as you usually do." Time to empty a cup is measured, and the drinking profile and episodes are monitored and assessed.</p> <p>[Drinking profile] 1. The patient can drink all the water in 1 gulp without choking. 2. The patient can drink all the water in 2 or more gulps without choking. 3. The patient can drink all the water in 1 gulp, but with some choking. 4. The patient can drink all the water in 2 or more gulps, but with some choking. 5. The patient often chokes and has difficulty drinking all the water.</p> <p>[Drinking episodes] Sipping, holding water in the mouth while drinking, water coming out of the mouth, a tendency to try to force himself/herself to continue drinking despite choking, drinking water in a cautious manner, etc.</p> <p>[Diagnosis] Normal : Completed Profile #1 within 5sec Suspected : Completed Profile #1 in more than 5sec, or Profile #2 Abnormal : Any cases of Profiles #3 through 5</p>

(Extracted from Kubota et al.³)

<p>Modified water swallow test</p> <p>[Procedure] The patient is given 3 mL of cold water in the oral vestibule, and then instructed to swallow the water. If possible, give more water and ask to swallow 2 more times, and the worst swallowing activity is to be assessed. If the patient meets Criteria #1 through 4, a maximum of 2 additional attempts (a total of 3 attempts) should be made, and the worst assessment will be recorded as the final result.</p> <p>[Assessment criteria] 1. Failed to swallow with choking and/or changes in breathing 2. Swallowed successfully without choking, but with changes in breathing or wet hoarseness 3. Swallowed successfully, but with choking and/or wet hoarseness 4. Swallowed successfully with no choking or wet hoarseness 5. Criteria #4, plus, 2 successful swallowing within 30 sec</p>
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(Extracted and modified from Saito.⁴)

test is intended to detect aspiration with high accuracy by having the patient swallow water.

In Japan, 2 methods with different quantity of water have been widely advocated: One uses 30 mL, and the other uses 3 mL (**Table 2**). According to the original method as proposed by Kubota et al.,³ 3 mL of water should be used on the first attempt, followed by additional 30 mL.³ However, since 30 mL of water poses greater risk for patients at risk of aspiration, Saito⁴ described a modified method that use 3 mL of water with close monitoring of the patient's condition. In either method, the patient's swallowing activity is monitored, and any choking is analyzed in terms of its nature.

Similar tests also exist that use custard pudding or jelly to evaluate swallowing function.

Colored water test

This test is used on tracheostomized patients. The patient is asked to swallow colored water to monitor any leakage from the tracheostomy incision. To color water, dyes such as Evans blue, methylene blue, or crystal violet are often used.

In patients with a tracheostomy tube, placing a piece of thin gauze or a twisted paper string between the tracheostomy incision and the tube makes it easier to confirm leakage. When doing so, extreme caution must be exercised to prevent such gauze or paper string from falling into the incision along with inhalation.

Cervical auscultation of swallowing

Cervical auscultation during or after swallowing allows noninvasive assessment of aspiration or the presence of residual food in the pharynx.⁵

Changes in breathing sound (mostly expiratory sound) and presence of a respiratory murmur in the pharynx after swallowing are particularly important in the assessment, such as moist sound, stenotic sound, wheezing, gargling sound, and liquid vibrating sound.

There have been studies on swallowing sound that can be heard for a short time during swallowing. However, so far no solid screening method has been developed since its mechanism is yet to be fully understood.

Swallowing provocation test (swallowing reflex test)

This method uses a thin tube inserted through the nose into the oropharynx area followed by injection of a small volume of water in order to measure the time from injection to start of swallowing reflex. In the method proposed by Teramoto et al.,⁶ the average time in healthy individuals was 1.7 seconds when using 0.4 mL of distilled water at normal temperature, and 3 seconds or longer is considered abnormal. It is expected, however, that these times may vary depending on the volume of water injected, water temperature, and injection rate. This test allows the assessment of sensory input and motor output in the pharynx in the absence of influence of the oral phase, and therefore can assess the risk of silent aspiration.

This method requires some experience of tube insertion. We otorhinolaryngologists often use this screening test in combination with video endoscopic monitoring of the laryngopharynx.

Tests That Require Special Equipment

This section describes 2 test methods that require special equipment.

Arterial oxygen saturation monitoring using pulse oxymeter

This method uses a pulse oxymeter to monitor arterial oxygen saturation (SpO₂) during meals to infer potential aspiration from decreased SpO₂. In practice, the patient should be instructed to discontinue a meal if his/her SpO₂ decreases to 90% or lower or by an average of 3% per minute from the baseline when eating. Although this test does not directly detect aspiration, it is useful in monitoring breathing condition during meals as risk management.⁷

Plain X-ray of the neck

The patient is asked to swallow a small volume of contrast medium. By comparing plain X-ray images of the neck taken before and after the swallowing, conditions of laryngeal influx and the presence of aspiration or pharyngeal residue can be found. Unlike X-ray fluoroscopy, this method does not allow dynamic monitoring of swallowing; however, it can be conducted easily using ordinary X-ray equipment.

Conclusion

Diagnosis of dysphagia begins with suspecting its presence, and then patients with high risk must be selected using simple screening tests, including those described in this paper. Many of these tests are relatively easy to perform and are extremely useful in obtaining a rough picture of the swallowing condition. On the other hand, most methods use choking as an indicator. The risk of silent aspiration in patients whose respiratory tract protection mechanism has been reduced or failed must not be overlooked, since this type of aspiration occurs without choking.

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