

# Application of Viscosity Volume Screening Tool as a screening tool in swallowing disorders diagnosis

## Zastosowanie Volume-Viscosity Screening Test jako przesiewowego narzędzia w diagnostyce zaburzeń połykania

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**ABSTRACT:** It is commonly known that dysphagia is associated with primary (malnutrition, dehydration, aspiration pneumonia) as well as secondary consequences (longer hospital stay, increased treatment cost, higher risk of mortality). Therefore, screening tests in swallowing disorders, especially done in at-risk groups, are essential. The aim of screening is identification of patients at risk of dysphagia and referring patients to further instrumental methods. The test should be noninvasive, quick, easy to perform by medical staff, with highest sensitivity and specificity. An example is the Viscosity – Volume Screening Test (VVST) with 3 different consistencies at 3 volumes (5, 10 and 20 ml), with wider possibilities of this tool in safe consistency and volume indication.

**KEYWORDS:** deglutition, deglutition disorders, questionnaires, dysphagia, screening

**STRESZCZENIE:** Powszechnie wiadomo, że występowanie dysfagii wiąże się z konsekwencjami zarówno pierwotnymi (niedożywienie, odwodnienie, zachyłkowe zapalenia płuc), jak i wtórnymi (dłuższy czas hospitalizacji, zwiększone koszty leczenia, wyższa śmiertelność). Z tego powodu tak ważne są badania przesiewowe w kierunku występowania zaburzeń połykania, szczególnie w grupach ryzyka. Celem badania przesiewowego jest identyfikacja chorych z zaburzeniami połykania wymagających dalszej pogłębionej diagnostyki przy użyciu metod instrumentalnych. Badanie przesiewowe powinno być nieinwazyjne, szybkie, łatwe do przeprowadzenia przez personel medyczny oraz charakteryzować się wysoką czułością i swoistością. Jednym z takich badań jest Volume-Viscosity Screening Test (VVST) wykorzystujące różne konsystencje w 3 objętościach (5, 10 i 20 ml), co poszerza możliwości narzędzia w zakresie wskazania nie tylko bezpiecznej objętości, lecz także także konsystencji.

**SŁOWA KLUCZOWE:** połykanie, zaburzenia połykania, kwestionariusze, dysfagia, badania przesiewowe

Deglutition disorders affect 8.1-80% patients following a stroke, 11-81% of patients with Parkinson's disease and as many as 30% with past craniocerebral traumas.

It is commonly known that the consequences of dysphagia are malnutrition, dehydration and aspiration pneumonia. Hence

the importance of screening in deglutition disorders, particularly in at-risk groups. The aim of screening examination is identification of patients with deglutition disorders who require further deepened diagnostics with the use of instrumental methods. Screening should be noninvasive, fast, easy and possible to be performed by medical staff. The choice of

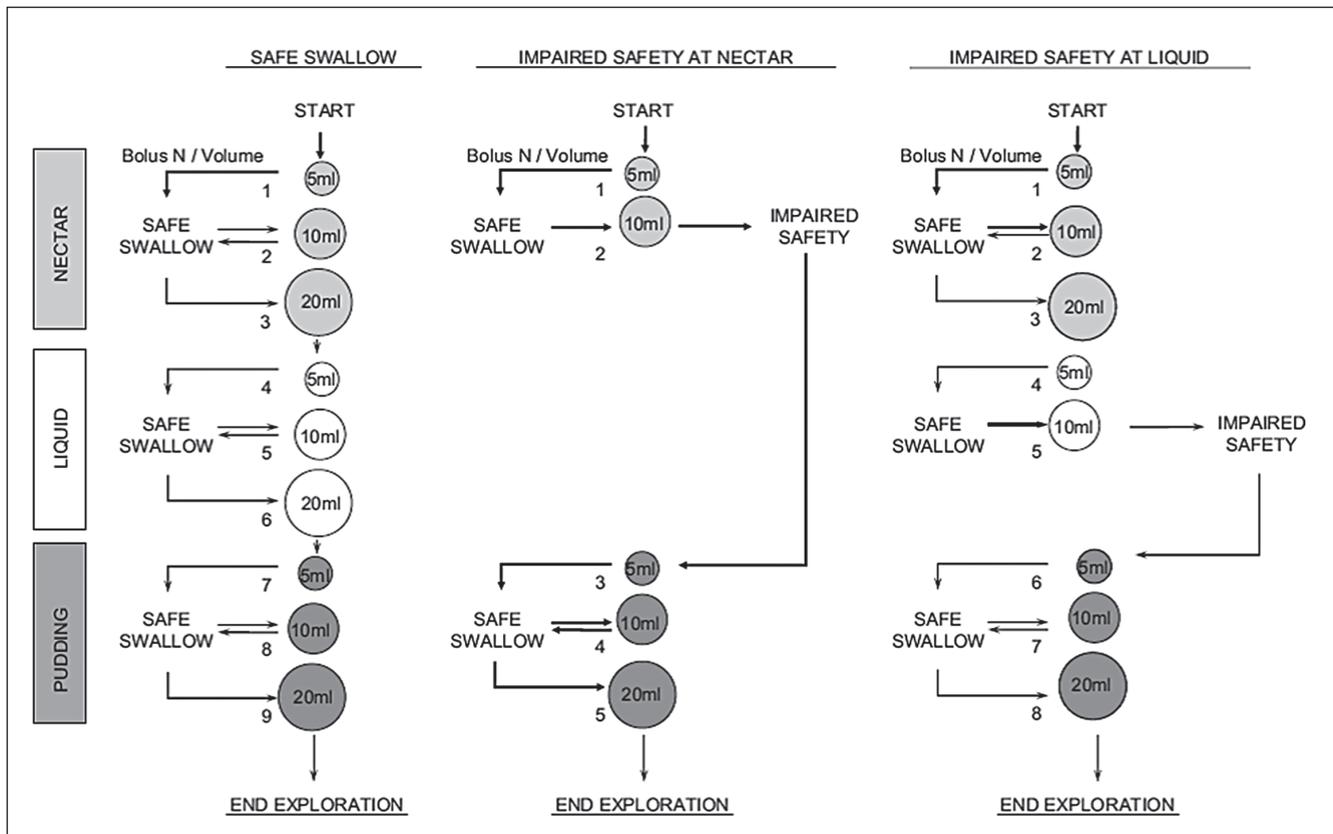


Fig. 1. Algorithms of bolus volume and viscosity administration during Volume-Viscosity Screening Test.

screening tool depends from psychometric characteristics. A screening tool of good quality should have 100% sensitivity and possibly the highest specificity [8]. In screening tests towards prevalence of deglutition disorders, one of the most commonly used tests is the water swallow test (sensitivity 51-85% and specificity 66-75% in evaluation of aspiration) [2; 3]. However, Bours et al. recommend expanding the water swallow test with monitoring of saturation and evaluation of the prevalence of symptoms such as: change of voice, cough and choking. VVST protocol meets this criterion, and the use of various consistencies expands the possibilities of the tool in indicating not only safe volume, but also consistency. Sensitivity and specificity of the test in identification of patients possible to improve the safety of swallowing through a change of consistency has been shown at a level of 84.6% and 73.4%, respectively. Despite the existence of a few tests that use various fluid consistencies, it is VVST that has allowed to identify cases of silent aspirations via assessment of saturation. The advantage of VVST in relation to water swallow tests is administration of different consistencies, including water, in small volumes. The authors underline the necessity to perform videofluoroscopy in all patients with at least one symptom of disturbed swallowing safety. According to Clave et al., VVST may be done by

physicians, nurses, dieticians as well as speech therapists. The aim of VVST is not only to identify patients with deglutition disorders who require deepened diagnostics, but also to choose the safest consistencies and volumes [4].

Evaluation of disrupted swallowing safety used changes of voice quality, cough and saturation lowered by more than 3% in comparison to the output saturation [4, 9,11]. The authors argue that evaluation of saturation makes it possible to identify cases of silent aspiration [10]. Measurement of saturation should take place 2 minutes before beginning the test and within 2 minutes of every swallow. The authors emphasize that changes in saturation or cough may occur not only when swallowing, but also prior (which may suggest lowered oral control of bite, with partial contact of the tongue with the posterior pharyngeal wall) or after swallowing, which may point towards the presence of residue in the pharyngeal cavity and post-deglutition aspiration. To establish the patient's voice quality before the test, the patient should be asked to speak their name (which then comprises a reference point). After every swallow, the patient is asked to speak their name. Changes in the form of wet voice, its weakening to aphonia included or recognition of the need to clear the pharynx before speaking a work indicate irregularities.

On the other hand, decrease in the effectiveness of swallowing is described as: poor lip closure (leakage), presence of swallowed contents in the mouth and pharynx (including the subjective feeling of the patient), multiswallowed bolus [4].

In line with the guidelines of National Dysphagia Task Force, water should have a viscosity of at least 1-50mPa/s, nectar 51-350 mPa/s, and pudding > 1750 mPa/s. For this purpose, the authors used still mineral water at room temperature as the first consistency. The consistency of nectar was obtained by adding 1.2g of Resource ThickenUp Clear, Nestle Health Science thickener to 100ml of water, whereas pudding consistency was prepared by adding 6g of thickener to 100ml of water [4].

VVST tool has so far been validated for a population of the elderly, patients with a past stroke, with neurodegenerative diseases and with head and neck cancers [6,10]. The mean time of examination was below 6 minutes [4]. VVST presents high diagnostic sensitivity (94%) and a high positive predictive value (98%) in identification of deglutition disorders and disrupted swallowing safety (aspirations and penetrations) (94% and 98% as well as 0.87 and 93%, respectively). In the case of aspiration, including silent aspiration, high sensitivity (91%) and a negative predictive value have been noted, with simultaneous low positive predictive value and specificity (28% and 21%, respectively). However, the authors indicate that a high positive predictive value in the evaluation of aspiration and penetration as well as disrupted swallowing safety and high negative predictive value for aspiration make VVST a significant tool in the identification of patients with risk of aspiration pneumonia [10]. Clave et al. indicate towards 100% sensitivity of the test in evaluation of aspiration, but low specificity at 28% [4]. In turn, Guillen –Sola et al. have noted sensitivity and specificity of the test in the scope of aspiration risk at 88.2% and 71.4%, respectively. Moreover, sensitivity and specificity in risk assessment for cough during and after swallowing at 82.4% and 54.3%, respectively have been shown, for a change of voice 80% and 50%, respectively, whereas for a change in saturation, 41.2% and 97.1% [6]. In their interpretation of credibility between evaluators in the scope of identification of deglutition disorders based on the Altman scale, both Rofes et al. [10] as well as Jorgensen et al. have indicated a good degree of compliance (kappa 0.628 (95% CI 0.45 – 0.78) and kappa 0.77 (95% CI 0.65 – 0.890), respectively) [7]. Research on larger groups is certainly required, both in more homogenous groups as well

as those at populational level.

## VVST TEST REPORT

Performance of the test requires: 200-ml cups, teaspoon, syringe, thickener, non-carbonated mineral water and a finger pulse oximeter, hygienic bib.

1. Firstly, fluid consistencies should be prepared (preferably 5 minutes before the test is commenced).
2. The patient should take a comfortable, sitting position with their back resting on a chair and feet on the ground. Unnatural placement and extension of the neck should be avoided.
3. The person conducting the test should sit slightly below the level and facing the patient.
4. Pulsoxymeter should be placed on the right index finger 2 minutes before the test is commenced. Output saturation value should be read and entered into the test form.
5. The patient should be asked to speak their name.
6. Test consistencies should be administered with a syringe in accordance with the test algorithm (Fig. 1)
7. The test begins with administration of a nectar consistency subsequently in volumes of 5, 10 and 20 ml. After each administered volume, the respondent should be observed in terms of symptoms of disrupted safety and lowered swallowing efficiency. In case of noting at least one symptom of disrupted swallowing safety, administration of a risky consistency should be interrupted and the test shall be continued with a pudding consistency, one again administering 5, 10 and 20 ml.
8. If the respondent did not show signs of disrupted safety and efficiency in swallowing the nectar, administration of water in increasing volumes begins. In case of noting at least one symptom of disrupted swallowing safety, administration of a risky consistency should be interrupted and the test shall be continued with a pudding consistency, one again administering 5, 10 and 20 ml.

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