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Original article

Interrater reliability of the Volume-Viscosity Swallow Test; screening for dysphagia among hospitalized elderly medical patients

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SUMMARY

Background: Oropharyngeal dysphagia (OD) is prevalent among medical and geriatric patients admitted due to acute illness and it is associated with malnutrition, increased length of stay and increased mortality. A valid and reliable bedside screening test for patients at risk of OD is essential in order to detect patients in need of further assessment. The Volume-Viscosity Swallow Test (V-VST) has been shown to be a valid screening test for OD in mixed outpatient populations. However, as reliability of the test has yet to be investigated in a population of medical and geriatric patients admitted due to acute illness, we aimed to determine the interrater reliability of the V-VST in this clinical setting. Reporting in this study is in accordance with proposed guidelines for the reporting of reliability and agreement studies (GRRAS).

Methods: In three Danish hospitals (CRD-BFH, CRD-GH, NDR-H) 11 skilled occupational therapists examined an unselected group of 110 patients admitted to geriatric or medical wards. In an overall agreement phase raters reached ≥80% agreement before data collection phase was commenced. The V-VST was applied to patients twice within maximum one hour by raters who administrated the test in an order based on randomization, blinded to each other's results. Agreement, Kappa values, weighed Kappa values and Kappa adjusted for bias and prevalence are reported.

Results: The interrater reliability of V-VST as screening test for OD in patients admitted to geriatric or medical wards was substantial with an overall Kappa value of 0.77 (95% CI 0.65–0.89) however interrater reliability varied among hospitals ranging from 0.37 (95% CI −0.01 to 0.41) to 0.85 (95% CI 0.75–1.00). Interrater reliability of the accompanying recommendations of volume and viscosity was moderate with a weighted kappa value of 0.55 (95% CI 0.37–0.73) for viscosity and 0.53 (95% CI 0.36–0.7) for volume. The overall prevalence of OD was 34.5%, ranging from 8% to 53.6% across hospitals. The prevalence and bias adjusted Kappa value (PABAK) was 0.76 (range 0.6–0.85). Mean time to perform the test was 13.1 min (SD 6.924).

Conclusions: The V-VST seems to be a moderately reliable screening tool for detecting OD among medical and geriatric patients. However, the recommendations of volume and viscosity add limited clinical value to the test.

1. Background

Increasing evidence has established that oropharyngeal dysphagia (OD) is a prevalent and potentially severe condition among older people [1–5]. In the course of aging the physiology of deglutition undergoes specific changes due to alterations in neural and muscular mechanisms [1,2] and cause a condition of presbyphagia which is largely asymptomatic in otherwise healthy elderly [4]. However, this diminished functional reserve may, when combined with acute illness, certain medications or polypharmacy, lead to manifest OD in frail elderly patients hospitalized for acute illness [2,6,7]. The exact prevalence of OD in elderly patients admitted to general hospital for acute disease is uncertain due to different definitions of OD, differences in patient selection and in the applied screening or assessment tools [1,3]. Studies reporting prevalence

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rates in this population often show widely varying prevalence, from 47% [3] to 55% [8] in patients admitted to acute geriatric ward and from 34.4% [9] to 91.7% in elderly patients admitted due to pneumonia [10]. Oropharyngeal dysphagia going unnoticed can lead to dire consequences for the individual in the form of malnutrition, dehydration or aspiration and furthermore it is strongly associated with increased length of stay and increased mortality during hospitalization [11]. Screening for OD among high-risk groups of patients is widely recommended and this may well be performed by staff not specialized in OD, provided that they have received basic training in administering the specific test [1,4,12]. Systematic reviews evaluating screening tests for OD highlight the need for tests that are valid and reliable, show a high sensitivity and are feasible to perform by non-specialized staff [13,14].The purpose of screening is to identify those patients that are at risk of having OD, and thus enable the referral to a clinical swallow assessment and to treatment by specialized staff such as speech and language therapists or occupational therapists (OT's) as is the common practice in Danish hospitals [15].

The Volume-Viscosity Swallow Test (V-VST) is a test that assesses the risk of OD in patients by evaluating the safety and efficacy of swallowing liquids in different volumes and viscosities. It has been presented as a generic screening test for mixed patient populations, including geriatric patients, patients with neurological disorders and patients with head and neck cancer. In these mixed populations, it has been shown to be a valid measure of OD with values of sensitivity between 87.0 and 88.2% and specificity between 64.7 and 81.0% for identifying impaired safety in swallowing [16–18].

Knowledge of the reproducibility of a measuring tool is crucial to judge the value of the tool for either research or clinical purpose, as it concerns the degree to which repeated measures in stable study objects or subjects provide similar results [19]. Both agreement and reliability are measures of reproducibility, but they should be differentiated as they answer different questions [20]. Agreement is an absolute measure that is concerned with measurement error and it informs clinicians about how well agreement is between repeated measurements and of the probability of agreement between clinicians [20]. Measures of reliability answer the question of how well subjects can be distinguished from each other despite the presence of measurement error. In the case of a screening test, such as the V-VST, measures of reliability are of interest since the purpose is to discriminate between subjects with or without the condition of interest [20]. Cohen's kappa is a measure of reliability that relates measurement error to the variation in the population sample. This is essentially why reliability is a characteristic of the performance of a test in a certain population sample and why the population sample should be chosen with regard to the prevalence of the condition of interest [21].

Only one previous study has examined the interrater reliability of the V-VST, presenting a substantial kappa value of 0.628 (95% CI 0.45–0.78) [17]. This study was conducted in the setting of a specialized outpatient clinic with patients referred specifically for evaluation of swallowing difficulties by staff who's level of familiarity with the V-VST was not described [17]. As reliability is a product not only of the test itself but also highly influenced by the raters who administer the test and the context in which it is applied, we find it relevant to examine how the V-VST performs when applied to heterogeneous groups of unselected patients in geriatric and medical wards on acute hospitals and when administered by skilled and well calibrated clinical staff. In contrast to the settings of specialized outpatient clinics, geriatric or medical wards in acute hospitals are often characterized by a higher patient flow and by having a sizeable group of staff employed. Thus, any screening test for OD employed in this sort of clinical setting must attest to its robustness and to its ability to differentiate adequately between patients with or without risk of OD independently of raters.

Therefore, we aimed to establish the inter-rater reliability of the Danish version of the V-VST applied to elderly patients admitted to geriatric or medical wards due to acute illness and administered by occupational therapists skilled in examining patients suspected of OD. Secondly, we wanted to estimate the prevalence of OD in this population.

2. Materials and methods

This inter-rater reliability trial of the Volume-Viscosity Swallow Test was designed and performed according to the guidelines for reproducibility and validity studies by the International Federation of Manual/Musculoskeletal Medicine (FIMM) [22] and reporting is in accordance with proposed guidelines for the reporting of reliability and agreement studies (GRRAS) [23].

It was a multi-center trial involving medical and geriatric wards in three different hospitals in Denmark; Capital Region of Denmark Bispebjerg-Frederiksberg Hospital (CRD-BFH), Capital Region of Denmark Gentofte Hospital (CRD-GH) and North Denmark Regional Hospital (NDR-H). The overall evaluation of the V-VST is dichotomous and indicates the presence or absence of OD. Thus, to secure a sufficient level of variation in observations and a sufficiently even distribution between patients with and without OD we aimed to include 110 patients, distributed on all three hospitals according to patient flow and number of available raters. Patients were recruited consecutively from June to October 2016. All patients admitted to medical or geriatric wards who gave their written informed consent were included without taking into account their potential history of OD. Patients were excluded if they had already been in contact with an occupational therapist during their admittance, if they were not sufficiently alert to be able to give informed consent and participate in the test and if language constituted a barrier for informed consent and participation in the test. Data collection ended when the assigned number of tests was reached. All patients who were asked to participate received verbal and written information about the purpose and procedure of the study. This study was approved by the Regional Ethics Committee of the Capital Region of Denmark, approval number 16020037 and was registered and approved by the Danish Data Protection Agency, J.nr. HGH-2016-063 I-Suite: 04610.

2.1. The Volume-Viscosity Swallow Test

The Volume-Viscosity Swallow Test was performed as described in the original study by P. Clavé et al. 2008 [16]. In the V-VST the patient's ability to swallow boluses of three different volumes (5, 10 and 20 ml) and three different viscosities (liquid, nectar and extreme spoon-thick) was tested. During swallowing trials the tester looked for specific signs of impaired safety (cough, changes in voice quality, a decrease in oxygen saturation $\geq$3%) and specific signs of impaired efficacy (impaired labial seal, oral residue, piecemeal deglutition, pharyngeal residue). In accordance with the V-VST algorithm the patient was first offered boluses of nectar viscosity in increasing volumes, starting with 5 ml. If the patient completed the nectar series without any signs of impaired safety the patient was offered boluses of liquid in increasing volumes. Finally, the patient was offered boluses of extreme spoon-thick viscosity in increasing volumes. However, if the patient displayed any sign of impaired safety while swallowing boluses of nectar viscosity these trials were interrupted, the liquid viscosity trials were omitted, and the test continued with boluses of extreme spoon-thick viscosity. Also, if the patient displayed any sign of

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