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ORIGINAL ARTICLE

Assessment of dysphagia with the V-VST in patients hospitalised after a stroke☆

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KEYWORDS
Dysphagia;
V-VST test;
Stroke

Abstract
Objective: The objective of this study is to describe the frequency of dysphagia and the associated factors in stroke patients hospitalised in the Neurology Unit of the *Hospital Clínico Universitario Lozano Blesa*, in Zaragoza, as well as to analyse the PPV and NPV of the volume-viscosity swallow test (V-VST).
Method: A cross-sectional descriptive study was conducted on stroke patients in order to assess the detectability of dysphagia using the V-VST and to track their progress for 7 days.
Results: The large majority (87.7%) of the patients did not have dysphagia. The study population included 81 subjects, of which 65.4% were men with a mean age of 72.84 years. The stroke was ischaemic type in 59.3% of cases, with no previous history of stroke in 86.4%, and with a slight dependence in 48.1% measured with Barthel index. The test was performed in the first 24 h in 79% of the population, with preventive dietary measures being introduced in 56.8% of patients. Some signs of lack of security were observed in 7 patients (8.6%) in the first week. Significant statistical relationships were found between the dysphagia and the dependence, signs of lack of security during the intake in the following days, and the type of diet. The PPV and NPV for V-VST in our patients was 14.28 and 94.11%, respectively.
Conclusions: The majority of patients did not have swallowing disorders due to their early detection with the V-VST, along with the dietary measures that appeared to reduce the risk of complications associated with dysphagia.

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PALABRAS CLAVE
Disfagia;
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Ictus

Valoración de la disfagia con el test MECV-V en pacientes ingresados tras un ACV

Resumen
Objetivo: Describir la frecuencia y los factores asociados de disfagia en los pacientes ingresados por ictus en la Unidad de Neurología del Hospital Clínico Universitario Lozano Blesa (Zaragoza), y analizar el VPP y el VPN del método de exploración clínica volumen-viscosidad (MECV-V).
Métodos: Estudio descriptivo transversal para evaluar la capacidad de detección de la disfagia del test MECV-V, y seguimiento de su evolución durante 7 días.
Resultados: El 87,7% de nuestros pacientes no presentaban disfagia; la población estaba formada por 81 sujetos, 65,4% hombres, con una media de edad de 72,84 años, ACV de origen isquémico en el 59,3%, sin antecedentes de ACV en el 86,4% y nivel de dependencia leve en el 48,1% medido con Barthel. El test fue realizado en las primeras 24 h al 79% de los sujetos, y se adoptaron medidas dietéticas en el 56,8%. Siete pacientes (8,6%) presentan signos de falta de seguridad la primera semana. Se encontró asociación estadísticamente significativa entre la disfagia y la dependencia, con los signos de falta de seguridad durante la ingesta en los días posteriores, y con la dieta. El VPP y el VPN para el test MECV-V en nuestros pacientes fueron de 14,28 y 94,11%, respectivamente.
Conclusiones: Los pacientes no presentaron en su mayoría problemas de deglución, debido a la detección precoz con el test MECV-V y las medidas dietéticas que parece que reducen el riesgo de presentar complicaciones asociadas a la disfagia.

Introduction

Cerebrovascular accidents (CVA) are the third cause of death in the western world, the second cause of dementia and the third cause of physical disability in adults. One of the potential complications of stroke is dysphagia or impaired swallowing,[1,2] which affects approximately 30% of patients.[3–14]

In the preconference on oropharyngeal dysphagia in stroke patients held in Barcelona in 2012, it was established that research into dysphagia should be evidence based, in order to create clinical practice guidelines to improve its treatment.[15] There are different methods to achieve this.[8] The gold standard is videofluoroscopy, a dynamic radiological technique that enables real time analysis of the propulsion of the bolus from the mouth towards the oesophagus by taking a sequence of lateral and anteroposterior images.[6,12,13,16–18] This is an expensive resource, which is not available in every hospital.[6,8,19,20] Therefore there are two methods of clinical examination, or clinical bedside assessment, that are easy to perform and have a grade B recommendation from the Scottish Intercollegiate Guidelines Network.[8,13,19,21]

The volume-viscosity swallow test (V-VST), devised by Dr Clavé and his team, is useful in identifying oropharyngeal dysphagea.[6,18,21–24] It is based on reducing the volume of the bolus and increasing viscosity thus improving swallowing safety.[18,21] It can diagnose aspiration with a diagnostic sensitivity of 83%–85%, and specificity of 64.7%–69%.[6,8,22] It enables dysphagia to be recognised, bronchoaspiration to be avoided and the patient's diet to be adapted to prevent subsequent complications. It is available in any setting and is low cost.[6,22] Furthermore, combining it with measurement of the Barthel index enables a complete care plan for patients with dsyphagia.[22,24]

Objective

To obtain data regarding the diagnostic capacity of the V-VST test, assessing whether the test was performed correctly, measuring signs indicative of bronchoaspiration with the test and in the days after it during the patient's hospital stay, with a view to describing the frequency of dysphagia and associated factors, and discover the patient's dietary progress during their admission.

Methods

A descriptive, cross-sectional study was performed of patients admitted after a CVA to the stroke/neurology unit of the *Hospital Clínico Universitario Lozano Blesa* from February to May 2016, who underwent the V-VST test, studying dysphagia in the patients and the positive and negative predictive values (PPV and NPV) of the V-VST test according to the signs presented 7 days after the test, and that were considered to be lacking safety (coughing, reporting of choking episodes).

To assess swallowing we administered boluses of 5, 10 and 20 ml of syrup, pudding and liquid consistency, after mixing liquid with thickener while monitoring saturation.[5,6,8,11,12,14,18,21–23,25,26] If, during the test, the patient showed any signs of impaired swallowing, the test was considered positive, i.e., the patient was not able to feed with this viscosity and volume of bolus. Otherwise the test was considered negative.[8,18,21,23,26]

All patients admitted during the period with a diagnosis of CVA who underwent the V-VST test were included, a total of 81, selected from the clinical data of the medical histories and treatment orders, and from the Gacela Care® programme, who could also be followed up for signs of lack of safety over 7 days.

The dependent variable of this study was the assessment of swallowing. The independent variables were: age, sex, CVA diagnosis, history of CVA, Barthel's index, time in hours from CVA until the V-VST test, diet, signs of lack of safety during intake, death and speech therapist consultation.

The data analysis was performed with IBM® SPSS® Statistics for Windows, version 21.0 (2012). We performed a univariate descriptive analysis and a bivariate study with the Chi-square/Fisher's exact test, calculating a 95% confidence interval for all the variables. The PPV and NPV of the V-VST test were also assessed.

Ethical considerations

The project was sent to the addresses of the hospital's medical and nursing staff, to the hospital's Ethics Committee, and the department head and unit supervisor were asked for their permission to review the clinical histories.

Results

The final study population comprised 81 patients with a mean age of 72.84 years (SD 12.53), of whom 53 (65.4%) were male. The commonest stroke was ischaemic (48 cases; 59.3%), and most of the patients, 70 (86.4%), had no history of stroke in their clinical history. Assessment of Barthel's index showed that the patients were mildly dependent for BADLs, with a mean score of 61.7 points (SD 29.41).

Most of the patients in the study, 64 (79%), underwent the V-VST within the first 24 h of admission to hospital. Seventy-one (87.7%) were found not to have dysphagia, the test was repeated for 5 patients (6.2%), and the end result was negative. After this first dysphagia assessment, oral diet was restarted adapted to each patient, the most frequent was ''pureed with thickened liquids'', tolerated by 32 patients (2.5) who required a nasogastric tube for enteral feeding after their stroke. No changes were made to the diet of 70 patients (86.4%) during their hospital stay.

We observed no signs of a lack of safety during intake, measured and recorded in the 7 days after the first assessment (cough, problems swallowing, referred to by the patient as ''choking'') in 68 (84%) patients. Only 7 (8.6%) patients died during the first week following admission (Table 1).

The bivariate study only revealed significant relationships between dysphagia and the Barthel index variables ($p < .001$), signs of a lack of safety during intake in the 7 following days ($p < .001$), and with the 2 variables that quantified the diets ($p < .001$ for both). No significance was found with the variables sex ($p = .273$), age ($p = .833$), diagnoses ($p = .214$), time since admission due to stroke until assessment of dysphagia ($p = .214$), previous CVA ($p = .527$), death during hospital stay ($p = .172$), and collaboration with speech therapist ($p = .101$) (Table 2).

To discover the association between the V-VST test and adapted diet grouped into 3 categories: ''non-dysphagia diet'', ''pureed diet and/or thickeners'' and ''nasogastric tube''.

We observed that the patients with no swallowing problems resumed tolerance with a non-dysphagia diet, and those that did have impaired swallowing were left fasting, or given enteral feeding via nasogastric tube. In contrast, of those who were taking a pureed diet and/or with thickened liquids, one patient (1.2%) presented dysphagia, and 45 (55.6%) did not. This is because, despite the negative test result, measures were taken to prevent complications with intake during these patients' hospital stay, such as resuming dietary tolerance with a pureed diet or using thickeners, raising the head of the bed or not using straws to drink liquids (Table 3).

Using the V-VST as the gold standard for dysphagia for our patients, we took the signs of lack of safety during intake, measured and recorded during the 7 days after the test to establish the PPV and NPV. We observed that 7 (8.6%) patients did show a lack of safety when swallowing, 68 (84%) did not, and 6 (7.4%) could not be measured due to issues related to the type of feeding. Removing these latter cases, 75 remained to assess the diagnostic strength of the V-VST test. The PPV for the V-VST test in our patients was 14.28%, and the NPV, 94.11%. The V-VST test was only able to detect 14.28% of the patients who had dysphagia, but 94.11% of those with safety problems in swallowing were detected with the test (Table 4).

Discussion

This study assesses the diagnostic capacity of the V-VST test, associated factors and nutritional progress of patients during their admission.

The large majority of our patients required dietary adaptation. Several studies mention adapted diets as a preventive measure for complications associated with dysphagia, and we can assume that the processing of foods is similar. Three studies report that 82.7, 45.6 and 84.6% of patients, respectively, required a dysphagia diet, and one specifies that 35.7% of their population had to take a pureed diet.[6,8,11,27] In contrast, we found 2 that differed: the first highlighted that 52.5% of their patients required a nasogastric tube, and 32% PEG; and the second found that the most frequent diet, with 54.6% of their population was normal.[10,25]

With regard to the time that the V-VST test was performed after admission to hospital with a stroke, we found that it was performed in the first 24 h in only 3 studies.[15,20,22] Finally, the research study by Bakhtiyari et al.[4] measured how the time that swallowing rehabilitation therapy is started after a CVA has an effect on its success, and found in their results that the group with the shortest time before starting therapy only required 10 sessions, compared to 32 of the group who started later.

We found no study that measured the signs of a lack of safety during intake 7 days after assessing dysphagia as we did in this study. Only one reports ''choking episodes'' experienced by patients in the 6 months before assessing dysphagia, 15.4% showed dysphagia using the V-VST test.[11]

Table 1 Description of the study population ($N = 81$).

	N (%)	Mean ± DT	Mode	Min.–max.
Age (years)				
<65	23 (28.4)	72.84 ± 12.530	85	29–94
66–75	22 (27.2)			
76–85	25 (30.9)			
>86	11 (13.6)			
Sex				
Female	28 (34.6)			
Male	53 (65.4)			
Barthel index				
Total dependency	8 (9.9)	61.17 ± 29.414	90	0–100
Severe dependency	10 (12.3)			
Moderate dependency	16 (19.8)			
Mild dependency	39 (48.1)			
Autonomous	8 (9.9)			
Diagnoses				
Haemorrhagic stroke	17 (21)			
Ischaemic stroke	48 (59.3)			
Stroke of unknown origin	16 (19.8)			
Time from stroke until V-VST test				
Up to 24 h	64 (79)			
Between 24 and 48 h	12 (14.8)			
More than 48 h	5 (6.2)			
First V-VST				
Dysphagia	10 (12.3)			
No dysphagia	71 (87.7)			
Second V-VST				
No dysphagia	5 (6.2)			
Not assessed	76 (93.8)			
Diet after first V-VST				
Pureed + thickener	32 (39.5)			
Normal	26 (32.1)			
Fasting	7 (8.6)			
Pureed	11 (13.6)			
Nasogastric tube	2 (2.5)			
Normal + thickeners	2 (2.5)			
Pureed with no liquids	1 (1.2)			
Diet 2				
Pureed + thickener	5 (6.2)			
Fasting	2 (2.5)			
Pureed	1 (1.2)			
Nasogastric tube	3 (3.7)			
No changes	70 (86.4)			
Signs of lack of safety 7 days after V-VST				
Yes	7 (8.6)			
No	68 (84)			
Not measured	6 (7.4)			
Previous stroke				
Yes	11 (13.6)			
No	70 (86.4)			

Table 1 (*Continued*)

	N (%)	Mean ± DT	Mode	Min.–max.
Death				
Yes	7 (8.6)			
No	74 (91.4)			
Collaboration with speech therapist				
Yes	2 (2.5)			
No	79 (97.5)			

We found the most similar assessment to ours in 2 research studies that report the percentages of aspiration pneumonia in their patients after the swallowing test at 17.7% and 8.7% respectively.[8,25] Some studies present measurements that show a lack of safety (respiratory complications) when their patients swallowed.[6,10,14,19]

The number of deaths in our study was low, we found extremes in the reference studies: either much higher or much lower rates.[6,8] There were also few collaborations with the speech therapy department of the *Hospital Clínico Universitario Lozano Blesa*, unlike the research study by Ferrero López et al. in 2009,where this was required for 36.3% of their population.[6]

Our study results show very few dysphagia cases, since only 12.3% of the patients had a positive V-VST test. We found papers in the literature that assessed swallowing using the V-VST test; others used the V-VST together with the gold standard, videofluoroscopy; and finally we found some research studies that used other bedside methods. All of them present far higher dysphagia rates than ours.

The research studies that use the V-VST method to detect dysphagia show figures ranging from 38.6%[22] to 47.4%.[7] Figures around 45% were the most commonly found, as occurs in various studies where the prevalence of dysphagia was 42.6[27] or 47.5%[14] in one that used an adaptation of the water-swallow test for the first 2 years and then the V-VST test for the following 4 years. The authors themselves highlight that the V-VST test is more reliable in detecting cases of dysphagia. There were results with higher dysphagia frequencies at 52.6% and 53.5%.[8,25] Those that obtained the 53.5% performed 2 types of assessments of the V-VST test: the V-VST test itself on one group, and a V-VST test adapted for patients with advanced dementia, and compared it with targeted anamnesis that assesses dysphagia through episodes of choking, or the need to thicken liquids.[25] We found somewhat higher prevalence in the studies by Ferrero López et al., one undertaken in 2012[11] and the other 2009.[6] In the most recent study, after assessing swallowing using the V-VST test, the authors found swallowing difficulties in 65% of their sample. The 2009 study confirmed the presence of dysphagia in 75% of the patients assessed. These authors also performed a second assessment, on 25.4% of the patients who presented dysphagia in the initial test, dysphagia having gone unnoticed in 28.6% of them.

We found 2 studies with figures that are around half the population with oropharyngeal dysphagia.[19,28] The first used a 32-item screen called MASSEY as their detection method, which assesses the patients' physical conditions, and a swallowing test that gives liquids of different consistencies called the GUSS test. FEES were also used to detect aspiration, and a percentage of 46.5% dysphagia was found. The second assessments, using the water-swallow and saturation test, detected aspiration in 52% of their patients.[19]

With regard to the statistically significant relationships we established in our study, we found that, like us, all the studies we consulted also found a relationship between dysphagia and dependency measured by the Barthel index,[6,7,11,25] and between dysphagia and the volume and consistency of diets.[25]

We found no statistically significant relationships in our study between dysphagia and sex[7,10,11,14,23] or between dysphagia and mortality.[6,7] In contrast to the results we obtained, we found a relationship between dysphagia and age in most of the literature we consulted; older people had more dysphagia.[7,14,23,25] The results that found a relationship between a history of CVA and a greater risk of dysphagia were also different to ours.[11,14,23]

Although we found no research study that measured the relationship between the time between testing for dysphagia and its subsequent onset, or signs of lack of safety during swallowing 7 days afterwards, there are 2 authors who, in a similar way, studied significant inverse relationships between starting rehabilitation early and dysphagia, and between dysphagia and the risk of aspiration, respectively.[4,8]

We observed that it is not easy to make comparisons in terms of PPV and NPV with other research studies, due to the diversity of criteria, assessment methods and clinical and demographic features of the patients. We obtained PPV and NPV of 14.28% and 94.11%, respectively, for the V-VST compared with signs of lack of safety during swallowing in the follow-up 7 days later. Ideally we should compare the V-VST test with the gold standard, videofluoroscopy, as in one of the studies where they obtained a 100% NPV, with a 100% sensitivity and specificity of 14.9%.[8] One of the research studies we consulted, where they compared the V-VST test and its adaptation for patients with advanced dementia with ''targeted anamnesis'' assessing dysphagia by episodes of choking or the need to thicken liquids, taking the V-VST as the gold standard, showed a PPV of 82.6% and NPV of 57.1%, a sensitivity of 41.3% and specificity of 90%.

The V-VST test in this study detected 10 cases of dysphagia, and only 7 patients had signs of a lack of safety when swallowing in the following days. The high NPV leads us to conclude that complications associated with dysphagia reduce.

As we undertook this study we found some limitations concerning how the ''diagnostic variables'' were recorded,

Table 2 Results of V-VST test and associated factors.

	Result of V-VST test		Chi square (*p*)	Fisher's (*p*)
	Dysphagia yes, *n* (%)	Dysphagia no, *n* (%)		
Sex			1.201	
Female	5 (6.2)	23 (28.4)	(.273)	–
Male	5 (6.2)	48 (59.3)		
Age (years)				
<65	4 (4.9)	19 (54.3)	.867	33.619
66–75	2 (2.5)	20 (24.7)	(.833)	(.841)
76–85	3 (3.7)	22 (27.2)		
>86	1 (1.2)	10 (12.3)		
Diagnoses				
Haemorrhagic stroke	2 (2.5)	15 (18.5)	3.087	7.490
Ischaemic stroke	4 (4.9)	44 (54.3)	(.214)	(.674)
Stroke of unknown origin	4 (4.9)	12 (14.8)		
Barthel's index				
Total dependency	5 (6.2)	3 (3.7)	26.6	19.528
Severe dependency	3 (3.7)	7 (8.6)	(<.001)	(<.001)
Moderate dependency	1 (1.2)	15 (18.5)		
Mild dependency	1 (1.2)	38 (46.9)		
Autonomous	0	8 (9.9)		
Time from stroke until V-VST test				
Up to 24 h	6 (7.4)	58 (71.6)	11.193	17.724
Between 24 h and 48 h	1 (1.2)	11 (13.6)	(.004)	(.214)
More than 48 h	3 (3.7)	2 (2.5)		
Signs of lack of safety				
Yes	1 (1.2)	4 (4.9)	30.590	19.036
No	6 (7.4)	64 (79)	(<.001)	(<.001)
Diet 1				
Pureed + thickeners	0	32 (39.5)	72.599	45.982
Normal	0	26 (32.1)	(<.001)	(<.001)
Fasting	7 (8.6)	0		
Pureed	1 (1.2)	10 (12.3)		
Nasogastric tube	2 (2.5)	0		
Normal + thickeners	0	2 (2.5)		
Pureed with no liquids	0	1 (1.2)		
Diet 2				
Pureed + thickeners	5 (6.2)	0		
Fasting	0	2 (2.5)	38.096	22.193
Pureed	0	1 (1.2)	(<.001)	(<.001)
Nasogastric tube	0	3 (3.7)		
No changes	5 (6.2)	65 (80.2)		
Previous stroke				
Yes	2 (2.5)	9 (11.1)	.401	
No	8 (9.9)	62 (76.54)	(.527)	(.619)
Death				
Yes	2 (2.5)	5 (6.2)	1.864	
No	8 (9.9)	66 (81.5)	(.172)	(.206)
Collaboration with speech therapist				
Yes	1 (1.2)	1 (1.2)	2.687	
No	9 (11.1)	70 (86.4)	(.101)	(.233)

Table 3 Adaptation of diet to patients' swallowing.

Relationship between the V-VST test and diet			
	V-VST, *n* (%)		Total
	Dysphagia	No dysphagia	
No dysphagia (normal)	0	26 (32.1)	26
Pureed diet and/or thickener	1 (1.2)	45 (55.6)	46
Other (nasogastric tube and fasting)	9 (11.1)	0	9
Total	10 (12.3)	71 (87.7)	81

Table 4 Benchmark values for calculating the positive and negative predictive values of the V-VST test.

PPV and NPV of the V-VST test/signs of lack of safety			
	V-VST +Dysphagia	V-VST −No dysphagia	
Lack of safety +	1	6	7
Lack of safety −	4	64	68
Total	5	70	75

because no taxonomy was used, and the ''V-VST'', since only the final assessment was recorded (positive or negative).

In sum, patients diagnosed with dysphagia should have individualised evidence-based treatment, including adapted diets with healthy and safe foods that provide hydration and nutrition. It is important that every care plan covers the patient's family, and we should not forget that eating and drinking is a social act that can affect the quality of life of our patients. Many of the compensatory measures for swallowing form part of nursing care.[3,12,17,26] Therefore, it is important to examine continuous care in depth.[5,6,10,18,22,28,29]

Conclusions

We conclude that the V-VST test is a good method for detecting dysphagia, since it was able to detect more patients with dysphagia than patients who had complications because of a poor previous diagnosis. Specific dietary measures were taken for the majority of the patients, which showed that there were very few patients who showed signs of a lack of safety while swallowing, and there were not a high number of deaths. We confirmed that dysphagia is associated with dependency for BADL, measured using the Barthel index, signs of a lack of safety while swallowing over the 7 subsequent days, and the type of diet adapted to the patient.

The results we obtained should be interpreted with care, bearing in mind that some relationships that were not significant might indeed prove significant in a greater sample size.

Conflict of interests

The authors have no conflict of interests to declare.

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