

Bedside Clinical Methods Useful as Screening Test for Aspiration in Elderly Patients with Recent and Previous Strokes

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Abstract

Introduction: This study was undertaken to ascertain the usefulness of clinical screening tools for dysphagia in a heterogeneous group of older stroke patients. The usefulness of bedside clinical assessment tools for detecting dysphagia on different consistencies of feeds was also studied. **Materials and Methods:** Fifty patients referred to a speech therapist for the assessment of possible dysphagia were recruited. The clinical tools studied included the water swallow test, the oxygen desaturation test and the combination of both tests (termed “clinical aspiration test”). The outcomes of the clinical assessments were compared with a fiberoptic endoscopic examination of swallowing (FEES) conducted at the same sitting. Fifty patients underwent an examination of their ability to swallow 50 mL of water in 10-mL aliquots. They underwent a FEES with different food consistencies by a speech therapist and oxygen saturation with pulse oximetry was monitored during the procedure. Oxygen desaturation of more than 2% was considered to be clinically significant. **Results:** The water swallow test had a sensitivity of 79.4% and specificity of 62.5% for the detection of aspiration, with a positive predictive value (PPV) of 81.8% and a negative predictive value (NPV) of 58.8%. The oxygen desaturation test had a sensitivity of 55.9% and a specificity of 100% with PPV of 100% and NPV of 51.6%. When both tests were combined, a sensitivity of 94.1% and a specificity of 62.5% was attained, with PPV of 84.2% and NPV of 83.3%. Using the clinical assessment test, we were able to pick up 3 aspirators who would otherwise have been missed if they were assessed with the water swallow test using thin fluids alone. **Conclusion:** Simple clinical assessment tools can be used to screen for dysphagia in a heterogeneous group of older patients with stroke disease, and clinical testing using feeds of different consistencies should be considered.

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Introduction

Cerebrovascular disease is the fifth commonest cause of hospitalisation in Singapore, and accounts for 2.7% of all hospital discharges.¹ Neurogenic dysphagia is a common complication of stroke disease and it has been shown that post stroke dysphagic patients have 6.95 times higher risk of developing pneumonia when compared to non-dysphagics.^{2,3} It has also been demonstrated that pneumonia resulting from aspiration is an important clinical problem in the elderly, and carries a mortality rate of 60%.⁴

In view of the high prevalence of dysphagia amongst hospitalised older persons, and the significant morbidity associated with complications arising from dysphagia, clinicians have sought to develop simple clinical screening tools for dysphagia. While a number of studies have shown that bedside clinical assessment of swallowing such as the 50-mL water swallow test and the oxygen desaturation test

can be used as screening tools, the great majority of these studies have been limited to “restricted” study populations i.e. patients who have suffered recent strokes.

We thus undertook a study to ascertain the usefulness of these bedside clinical methods (water swallow test and oxygen desaturation test) in detecting aspiration in a heterogeneous group of elderly patients (both acute as well as previous strokes). We also investigated whether bedside clinical methods may be useful for detecting aspiration in patients who are fed fluids of different consistencies using aspiration on fiberoptic endoscopic examination of swallowing (FEES) as the objective measure of aspiration.

Materials and Methods

Patients

Fifty consecutive patients who were referred to the Speech Therapy Department for the assessment of suspected

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dysphagia during the period between April 2000 and September 2001 were recruited for our study. Only patients who fulfilled our inclusion criteria and who gave written consent were included. These patients were from the Departments of Geriatric Medicine, General Medicine, Tan Tock Seng Hospital and the Department of Neurology in the National Neuroscience Institute.

Only patients greater than 65 years of age who had suffered recent strokes (acute cerebrovascular accident being the principal diagnosis for admission), or gave a history of previous stroke disease but presented with clinical features suggestive of dysphagia without a recent clinically evident cerebrovascular event were recruited. All patients had to be medically stable, alert and able to be propped up in bed.

Exclusion criteria included patients with contraindications to FEES, e.g. history of nasal problems or nasal surgery, base of skull fracture and coagulopathy. Patients with possible difficulties in obtaining accurate readings of capillary oxygen saturation were also excluded, e.g. patients with peripheral vascular disease, severe pneumonia, chronic obstructive airway disease, patients with cardiac problems, e.g. ventricular septal defect with Eisenmenger's syndrome, severe congestive cardiac failure and polycythaemia. Hospital ethics committee approval was obtained for the study.

Basic bio-demographic data collected included age, gender, history of previous stroke disease, side of hemiplegia or hemiparesis, presence or absence of facial nerve palsy, weak voluntary cough and abnormal palatal sensation. Clinical assessment of all patients were carried out according to the following protocol:

Water Swallow Test

All patients were asked to drink 50 mL of water in 10 mL aliquots while seated in an upright position. They were deemed to have failed the water swallow test if they coughed or choked during the water drinking or had a change in voice quality following the swallow.

Oxygen Desaturation Test

The oxygen desaturation test was conducted following a 10-minute interval after the water swallow test, and was carried out concurrently with FEES by a speech therapist. A Novametric Oxyleth pulse oximeter (Model 520A) was used for the oxygen desaturation test, with the finger probe being placed on the index finger of the unaffected hand for patients with hemiparesis or hemiplegia.

A baseline oxygen saturation reading was taken after an interval of 5 minutes to allow for equilibration. Maximum and minimum readings during and up to 2 minutes after the assessment of swallowing on each of the different feed

consistencies during FEES were recorded (vide infra). Oxygen desaturation of $\geq 2\%$ was considered to be clinically significant.

Clinical Aspiration Test

Patients were deemed to have "clinical aspiration" if they failed the water swallow test or if they demonstrated desaturation of $\geq 2\%$ on any of the food consistencies during FEES. Both phases of the clinical assessment were conducted by a geriatrician (MSC, PKL, YYS).

FEES

At the same time as the oxygen desaturation test, all patients underwent a FEES using an Olympus ENF-P3 laryngoscope attached to a CCD camera and a colour monitor. This was done by a speech therapist who was blinded to the results of the clinical assessment.

During FEES, patients were fed different food consistencies (honey-thickened feeds, nectar-thickened feeds, thin fluids and paste consistency) with a large spoon (8 mL), with each patient being given 3 to 5 spoonfuls. The feeds were coloured with a blue food dye for ease of visualisation. Any premature spillage, penetration (defined as any material entering the laryngeal vestibule but remaining at or above the levels of the vocal cords) or aspiration (defined as penetration below the level of the vocal cords) was noted. Patients were observed for an additional 2 minutes if they were noted to have significant pharyngeal residue.

The FEES was terminated if the patient was noted to have significant aspiration on any consistency or if the speech therapist felt that it was unsafe to continue. Aspiration was considered to be present on FEES if there was any aspiration or penetration on any food consistency.

Statistical Analysis

All analyses were done using SPSS version 9 for Windows. The kappa statistic was calculated to determine the level of agreement between the clinical assessment tools (water swallow test, oxygen desaturation test and clinical aspiration test) and the findings on FEES. In addition, the chi-square test was applied to determine the strength of statistical association between the findings on clinical assessment and the findings on FEES. Similarly, the sensitivity, specificity as well as the positive predictive value and negative predictive values were calculated for each of the clinical tools, using aspiration on FEES as the objective measure of aspiration.

Results

Of the 50 subjects studied, 12 had suffered recent strokes, with 5 of these having had recurrent cerebrovascular events. Thirty-eight of the 50 subjects gave a history of previous

stroke disease but did not have clinical evidence of a recent cerebrovascular event.

The basic demographic data and outcomes of the clinical assessment protocol and the FEES are presented in Table I. Of the 34 patients found to have aspiration on FEES, 7 could not complete assessments using all 4 consistencies of feeds because the speech therapist felt it was unsafe to do so. These patients were considered to be unsafe for oral feeding on all consistencies.

Both the water swallow test and the oxygen desaturation test were found to have good agreement with the findings on FEES (kappa = 0.41 and 0.45, respectively). However, when both clinical methods were combined (i.e. “clinical aspiration”), the agreement was found to be very good (kappa = 0.61). This was found to be so even if the group consisting of patients without recent strokes was analysed separately.

Using aspiration on FEES as the gold standard for comparison, the water swallow test had a sensitivity of 79.4% and a specificity of 62.5%. The corresponding positive predictive value was 81.8% and the negative predictive value was 58.8% ($\chi^2 = 8.52$, $P = 0.004$). Comparatively, the oxygen desaturation test had a lesser sensitivity of 55.9% but a greater specificity of 100%. It had a positive predictive value of 100% and a negative predictive value of 51.6% ($\chi^2 = 14.42$, $P < 0.001$). However, when both clinical assessment tools were combined into one test, with patients being defined as having clinical aspiration when they failed either of the tests, the sensitivity increased to 94.1%, and the specificity increased to 62.5%. The positive predictive value of the clinical aspiration tool was 84.2% and the negative predictive value was 83.3% ($\chi^2 = 19.12$, $P < 0.001$) (Tables II and III).

Clinical Assessment of Swallowing Using Different Consistencies of Feeds

Of the 34 patients who were found to aspirate on FEES, only 12 patients aspirated on a single feed consistency.

TABLE I: BASIC DEMOGRAPHIC DATA AND OUTCOMES OF DYSPHAGIA ASSESSMENT TESTS

	Recent stroke	No recent stroke
Number	12	38
Male:Female	8:4	18:20
Mean age (SD)	73.08 (6.33)	76.21 (6.86)
Number failed water swallow test (%)	11 (91.7)	22 (57.9)
Number failed oxygen desaturation test (%)	4 (33.3)	25 (39.5)
Number with clinical aspiration i.e. failed water swallow test or oxygen desaturation test (%)	12 (100)	26 (68.4)
Number with aspiration on FEES (%)	8 (66.7)	26 (68.4)

TABLE II: RESULTS OF 50 ML WATER SWALLOW TEST, OXYGEN DESATURATION TEST AND CLINICAL ASPIRATION IN ASPIRATING AND NON-ASPIRATING PATIENTS

Test	Aspirators (%)	Non-aspirators (%)	χ^2	P	Kappa
Failed water swallow test	79.4	37.5	8.52	0.004	0.41
Oxygen desaturation test	55.5	0	14.42	<0.001	0.45
Clinical aspiration	94.1	37.5	19.12	<0.001	0.61

TABLE III: SENSITIVITIES, SPECIFICITIES AND PREDICTIVE VALUES FOR THE DETECTION OF ASPIRATION

Test	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
Water swallowing	79.4	62.5	81.8	58.8
Oxygen desaturation	55.9	100	100	51.6
Clinical aspiration	94.1	62.5	84.2	83.3

Four patients aspirated on 2 consistencies and 8 aspirated on 3 consistencies. Three completed testing on all 4 consistencies and were found to be dysphagic on all 4, while 7 patients had their FEES terminated halfway because the speech therapist considered it unsafe to complete the procedure. These 7 patients were thus considered to be unsafe for oral feeding on all 4 consistencies.

Three of the aspirators did not demonstrate aspiration on thin fluids but aspirated on other consistencies. These patients would have been missed if bedside clinical assessment was done using thin fluids alone (i.e. 50-mL water swallow test). Conversely, these patients were picked up using the combined “clinical aspiration test” which included the assessment of oxygen saturation on different consistencies of feeds.

Discussion

Instrumental assessment of swallowing has long been regarded as the gold standard for the diagnosis of swallowing dysfunction, and has been especially useful in the detection of silent aspiration that is not detected by bedside clinical methods. Such instrumental assessments include video-fluoroscopy and more recently, FEES.

Numerous attempts have been made to devise bedside clinical methods as screening tools for the identification of patients with dysphagia. An example of such a screening tool is the Burke dysphagia screening test that has been used to identify acute stroke patients who are at risk of aspirating. The Burke’s dysphagia screening test was shown to have a sensitivity of about 85% and specificity of 45%.⁵⁻⁸ Similarly, the 50-mL swallow test has been found to be a good screening tool in detecting undiagnosed dysphagia.⁹ Apart from the observation of clinically evident signs of

aspiration, it has been suggested that the detection of oxygen desaturation using pulse oximetry may be useful for the detection of silent aspirators.¹⁰⁻¹³ Zaidi et al¹⁴ studied acute stroke patients and found significant desaturation in aspirators compared to non-aspirators and proposed the use of this technique as an alternative to instrumental assessment of dysphagia. Collins and Barheit¹⁵ compared oxygen saturation levels with simultaneous video-fluoroscopy and found that a drop of 2% or more was a clinically significant indicator of aspiration. Smith et al¹⁶ found that the combination of bedside swallowing assessment and oxygen saturation monitoring had a positive predictive value of 95% for aspiration in patients with acute stroke. This finding has been further verified by Lim and colleagues,¹⁷ who showed that such a combination of tests had a sensitivity of 100% and a specificity of 70.8% for the detection of aspiration in acute stroke patients when compared to FEES.

The great majority of the studies mentioned above have involved only patients who have suffered recent strokes. In our study, we examined the usefulness of two clinical screening methods (separately and combined as a single index) in detecting aspiration in a heterogeneous group of older patients, using aspiration on FEES as the gold standard for comparison.

In our study, the water swallow test had a sensitivity of 79.4% and a specificity of 62.5%. The positive predictive value of the water swallow test was 81.8%. These results were comparable to similar studies performed earlier with acute stroke patients,¹³ thus suggesting that this test may be applied to a heterogeneous group of acutely ill older persons. As mentioned earlier, the main limitation of the water swallow test was its inability to identify silent aspirators. To detect silent aspirators who were not picked up by the 50-mL water swallow test, we performed the oxygen desaturation test using feeds of different consistencies.^{12,13} Our results compare favourably with previous studies, demonstrating a significant association between oxygen desaturation on swallowing and aspiration/penetration on FEES.^{16,17} In our study population, the oxygen desaturation test had a positive predictive value of 100%, which meant that all patients who desaturated had aspiration/penetration on FEES.

The combination of both clinical screening tools into a single index (clinical aspiration) proved to be a sensitive screening instrument. The high sensitivity and specificity attained with this simple clinical assessment technique in a study population comprising both older persons with recent strokes and those without clinical evidence of a recent cerebrovascular event suggests that it may be used as a screening tool for dysphagia in a heterogeneous group of acutely ill older persons and that its usefulness extends

beyond the group of patients with recent strokes. Furthermore, our results suggest that this "combined" test is superior to the 50-mL water swallow test because of its ability to detect silent aspiration.

We recognise that our study population comprised patients who were referred to the speech therapy department because they were suspected to have dysphagia, i.e. there was a high pre-test probability of a positive test. Nonetheless, the high positive and negative predictive values of these tests (based on concurrent instrumental assessment) and the ease of administration of these clinical assessment tools suggest that they can be applied in any ward setting where acutely ill older persons are encountered. Overtly dysphagic patients or those at risk of silent aspiration who are thus identified can then be referred for a more thorough evaluation by speech therapists. Similarly, patients who are screened to be at low risk of aspiration can be started on oral feeding with minimal delay.

Our study also demonstrated that it was useful to consider including different consistencies of feeds when using clinical screening tools for dysphagia.^{18,19} This is an area that has not received much attention and deserves further studies.

In summary, the combination of the 50-mL water swallow test and the oxygen desaturation test is a sensitive screening instrument for identifying dysphagia and silent aspiration in a heterogeneous group of acutely ill older patients. Once identified, these patients can then be referred for more definitive assessment using either modified videofluoroscopic examination or FEES. The benefit of this bedside clinical assessment method lies in its ease of administration and its high sensitivity and specificity. Future studies on clinical assessment methods for dysphagia should also include assessment for dysphagia/aspiration using different consistencies of feeds.

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