

Dysphagia Screening Tools: A Review June 2008

**Prepared for OREG by:
The Dysphagia Screening Tool Working Group**



Ontario
Stroke
System

Dysphagia Screening Tools: A Review

Background

Dysphagia is a significant consequence of stroke, occurring in approximately 50 to 55% of stroke survivors (Martino, Foley, Bhogal, Diamant, Speechley, and Teasell, 2005). Stroke survivors with dysphagia can develop serious complications, such as aspiration pneumonia, malnutrition, and dehydration. Martino et al., (2005) found that patients with dysphagia after stroke had 3 times greater relative risk of pneumonia than stroke patients without dysphagia; and when those dysphagia patients were confirmed aspirators the relative risk of pneumonia rose to 11 times greater.

Research has shown that early intervention through dysphagia screening may positively alter health outcomes. Martino, Pron and Diamant (2000) found evidence suggesting that dysphagia screening leads to improved health outcome through reducing risk of developing pneumonia, reducing risk of mortality and reducing PEG insertion rates. Hinchey, Shephard, Furie, Smith, Wang and Tonn (2005) found that pneumonia rates were 2.4% at sites with a formal dysphagia screening protocol versus 5.4% at sites with no formal screening. Both of these studies highlight the need to have a formal dysphagia screening protocol in place for stroke patients in order to reduce risk of complications and improve health outcome.

Through a consensus process with a panel of experts, the Heart and Stroke Foundation of Ontario (HSFO) developed Best Practice Guidelines for Managing Dysphagia (2002). These guidelines indicate that all acute stroke patients be kept NPO including medications until their swallowing ability has been determined and that all stroke survivors should be screened for swallowing difficulties as soon as they are awake and alert. Implementation of the HSFO Best Practice Guidelines, including implementation of a swallowing screening tool, may help minimize the risk that stroke survivors will develop dysphagia-related complications.

What is a screening tool?

Swallowing screening provides an indication of the likelihood of the presence or absence of dysphagia and identifies patients who require referral to a speech-language pathologist or other health professional for a comprehensive evaluation of swallowing function. Bedside screening results do not indicate the nature or severity of oropharyngeal dysphagia and should not be used to design interventions (College of Audiologists and Speech-Language Pathologists of Ontario (CASLPO), 2007; Canadian Association of Speech-Language Pathologists and Audiologists (CASLPA), 2007)

Canadian Best Practice Recommendations for Stroke Care (Canadian Stroke Network & Heart and Stroke Foundation of Canada, 2006) indicate that the swallow screening tool should be simple, and proven valid (accurately reflects the concept that it was intended to measure), and reliable (able to measure in a reproducible fashion). Measures of reliability and validity provide the user with an indication of how well a dysphagia screening tool might function with a particular patient group or in a certain setting.

What are the appropriate components of a swallowing screening tool?

Heart and Stroke Foundation of Ontario (HSFO) and Registered Nurses' Association of Ontario's (RNAO) (2005) publication entitled *Stroke Assessment Across the Continuum of Care* suggested that a dysphagia screening tool contain:

- Assessment of the client's alertness and ability to participate.
- Direct observation of oropharyngeal swallowing difficulties (choking, coughing, wet voice).
- Evaluation of the patient's voice quality, oromotor function, oral sensation, and ability to cough.
- Trials of water using a present protocol.

The College of Audiologists and Speech-Language Pathologists of Ontario (CASLPO, 2007) recommends that "wherever possible ... swallowing screening be conducted by a trained and regulated health care provider ..." (p 18). This highlights the need for an appropriate training program to be a part of the implementation of any swallowing screening test.

Stroke Regions within the Ontario Stroke System as supporters of evidence-based practice recognize the need to establish Dysphagia Management Programs that include the use of a simple, valid, reliable screening tool. In an effort to support Stroke Regions in identifying an appropriate swallowing screening tool, the Dysphagia Screening Tool Working Group (Appendix A) was established to review the literature and report on swallowing screening tools now available.

Method

The search of peer-reviewed articles published from 1987 through to the first week of November 2007 comprised a structured search through Medline and CINAHL databases limited to English language articles on humans using the following search strategy:

1. exp Deglutition Disorders/
2. Deglutition/
3. (deglutition or swallow or dysphagia).tw
4. 1 or 2 or 3
5. exp Cerebrovascular Accident/
6. 4 and 5
7. exp evaluation/
8. exp diagnosis/
9. exp screening/
10. 7 or 8 or 9
11. 6 and 10

In addition, there was an unstructured search of relevant research literature.

From the data retrieved, articles selected for review were those that were limited to bedside screening for oropharyngeal dysphagia in adult acute stroke patients.

The Working Group reviewed:

- Burke Dysphagia Screening Test & 3-oz Water Swallowing Test (DePippo, Holas and Reding, 1992; DePippo, Holas and Reding, 1994)
- Bedside Swallowing Assessment (Smithard, O'Neill, Park, England, Renwick, Wyatt, Morris and Martin for The North West Stroke Dysphagia Project Group, 1998)
- The Gugging Swallow Screen (Trapl, Enderle, Nowotny, Teuschl, Matz, Dachenhausen and Brainin, 2007)

- Massey Bedside Swallow Screen (Massey and Jedlicka, 2002)
- Clinical Assessment of Swallowing (Daniels, McAdam, Brailey and Foundas, 1997; Daniels, Ballo, Mahoney, and Foundas, 2000)
- 50 ml water swallow test and/or pulse oximetry (Lim, Lieu, Phua, Seshardri, Venketasubramanian, Lee and Choo, 2001)
- Pharyngeal Sensation Assessment, Oromotor Assessment, and 50-ml Water Test (Kidd, Lawson, Nesbitt and MacMahon, 1993)
- Gag Reflex (Ramsey, Smithard, Donaldson and Kalra, 2005)
- Screening Tool for Acute Neurological Dysphagia (STAND) (Shephard, 2007)
- 30-ml water swallowing test (Nishiwaki, Tsuji, Liu, Hase, Tanaka and Fujiwara, 2005)
- Swallowing Provocation Test (Teramoto and Fukuchi, 2000)
- Standardized Swallowing Assessment (SSA) (Ellul, Barer, and the North West Study Group, 1993, 1996; Ellul, Barer and Fall, 1997; Perry, 2001 a, b)
- Timed Test of Swallowing and Questionnaire (Hinds and Wiles, 1998)
- Toronto Bedside Swallowing Screening Test (TOR-BSST[®]) (Martino, Silver, Teasell, Bayley, Nicholson, Streiner and Diamant, in press; Swallowing Lab Website - <http://swallowinglab.uhnres.utoronto.ca/torbsst.html>).
- Oxygen Saturation Monitoring (Smith, Lee, O'Neill and Connolly, 2000)
- 50ml³ Drinking Test (Gottlieb, Kipnis, Sister, Vardi and Brill, 1996)

Members of the Working Group reviewed the articles using the criteria in Appendix B to determine whether they met the criteria of:

- Containing the four procedural elements described in HSFO and RNAO's (2005) *Stroke Assessment Across the Continuum of Care*
- Simple
- Valid
- Reliable

Results

From the articles reviewed, the Working Group identified five bedside dysphagia screening tools for acute stroke patients that could be administered by any health care professional and contained the recommended four procedural elements. These dysphagia screening tools were:

- **Massey Bedside Swallow Screen** (Massey and Jedlicka, 2002)

The Massey Bedside Swallowing Screen is a 14-point screen that examines alertness level, dysarthria, aphasia, oral motor abilities, gag reflex, and incorporates observations of a 1-teaspoon water swallow followed by a 60 cc water swallow.

The Massey Bedside Swallow Screen appears to have good validity, reliability, sensitivity and specificity but the study undertaken used a small sample from one site (n= 25) thus affecting the generalizability of the findings to other centres. In addition, the measurement properties of the Massey Bedside Swallow Screen were assessed when two research assistants used the tool. Education given to the screeners is not described. It is not known how well the Massey Bedside Swallow Screen would function in Ontario as a dysphagia screening tool when used by other members of the health care team.

- **Timed Test of Swallowing and Questionnaire** (Hinds and Wiles, 1998)

Patients are pre-screened and patients who have a depressed level of consciousness (Glasgow Coma Scale <13 and drowsy) or unable to sit upright (with aid) are not screened. Each patient answers a standard questionnaire relating to their swallowing and undergoes the timed test of swallowing.

The timed test of swallowing involves:

- 5-10ml of water from a teaspoon. Patients choking on this amount do not proceed to the full test, and are recorded as an abnormal test.
- 100-150ml of water is given and the patient is asked to drink all the water as quickly as possible. Any residual water left over is measured. The number of swallows is counted and the time taken to swallow is measured.

The test is abnormal if either the quantitative or qualitative aspects of the swallow are outside normal limits.

Only the quantitative component of the Timed Test of Swallowing has good sensitivity to the presence of dysphagia and there is no data on the reliability of this tool. In addition, a neurologist conducted the screening in the research study so the measurement properties of the Timed Test of Swallowing are not known when other members of the health care team use this test. Education given to the screeners is not described.

- **Toronto Bedside Swallowing Screening Test (TOR-BSST[®])** (Martino, Silver, Teasell, Bayley, Nicholson, Streiner, Diamant, in press; The Swallowing Lab website - <http://swallowinglab.uhnres.utoronto.ca/torbsst.html>).

The TOR-BSST[®] screen includes 4 clinical test items: observation for general dysphonia ('voice before' and 'voice after'), tongue movement, and water swallows using a preset protocol.

The TOR-BSST[®] is a tool recently developed in Ontario. The TOR-BSST[®] has good reliability and validity with high sensitivity and high negative predictive value. Test item selection was based upon best available evidence, derived from an extensive systematic review (Martino et al, 2000). TOR-BSST[®] was studied using a randomized controlled diagnostic study design. Dysphagia was defined to be "any swallow-associated abnormal physiology in the upper aerodigestive tract, including aspiration during intake of liquid or solid boluses" (Martino et al, in press) and was captured with gold standard videofluoroscopy.

A comprehensive education program was developed for the TOR-BSST[®]. Education includes a 4-hour didactic session which trains screeners to administer and interpret the TOR-BSST[®] using digitized real-life examples of five stroke patients. Training also includes review of basic anatomy and physiology of swallowing as well as strategies for administering the TOR-BSST[®] to patients with receptive and/or expressive aphasia. Screeners are also taught how to determine whether patients meet the criteria for dysphagia screening. This criteria includes being alert, able to sit upright (with or without support), and able to follow simple instruction. Patients who do not meet these three criteria are referred directly for a swallowing assessment. Didactic training is followed by individual training / competency observations where screeners are supervised as they independently administer the TOR-BSST[®] to two stroke patients. Training is facilitated by a speech-language pathologist who has expertise in assessment and management of dysphagia post-stroke and who has completed the "TOR-BSST[®] Training for the SLP Dysphagia Expert" course."

The full research paper has been accepted for publication in Stroke.

- **Screening Tool for Acute Neurological Dysphagia (STAND)** (Shephard, 2007)

The STAND screen involves: evaluating patients for alertness and oxygen saturation levels, voice quality and ability to manage oral secretions, history of dysphagia, a swallow challenge with puree and water, and observations for specified signs of impaired swallowing. No training program has been described at this time.

The STAND is a recently developed tool. While its sensitivity to dysphagia appears promising, details of the research methodology used to test its measurement properties are not yet available in a peer reviewed publication.

- **Standardized Swallowing Assessment (SSA)** (Ellul et al., 1993, 1996, 1997; Perry, 2001 a,b).

The SSA consists of:

- General assessment (e.g. conscious level, postural control) in order to ensure the patient is physically capable of undertaking screening
- Assessment of ability to cough, saliva control, breathing, voice quality
- Ability to sip water from a spoon, and drink water from a glass.

Specific clinical signs (voice quality, coughing) are recorded and an overall judgement on swallowing safety is made.

Education and training consists of a single theory day, focused on the anatomy and physiology of swallowing and the identification and management of dysfunction, followed by a minimum of five successfully completed supervised screening episodes to establish competence.

The SSA's predictive validity has been documented. When used by nurses, the sensitivity, specificity, and inter-rater reliability of the SSA are reported to be high. However, the series of studies undertaken to assess the measurement properties of the SSA had limitations in research design, including small sample size, and subject selection and measurement bias. As a consequence, it is not known how well the SSA would function in Ontario as a dysphagia screening tool for all acute stroke patients.

Further information, including level of evidence, validity, reliability, and sensitivity and specificity data, for these five dysphagia screening tools is summarized in Appendix C.

Conclusion

Of the 5 screening tools reviewed in detail, the TOR-BSST[®] is the most thoroughly evaluated dysphagia screening tool, based upon best available evidence. The measurement properties of the TOR-BSST[®] have been established in a well-controlled study. As well, the TOR-BSST[®] has a prepared education module. The TOR-BSST[®] functions well when used by nurses in Ontario to screen for dysphagia. Screeners can be confident that a stroke patient with a negative screen will not have dysphagia.

Dysphagia screening is an important component of a regional Dysphagia Management Strategy and should be used only as a means to identify those stroke survivors who are at risk of dysphagia and therefore require a comprehensive Speech-Language Pathology swallowing assessment (CASLPO, 2007; CASLPA, 2007). Access to Speech-Language Pathology services may determine which hospital facilities are best able to manage stroke patients with dysphagia safely and appropriately. Stroke regions and individual hospital facilities are encouraged to carefully consider all aspects of the available screening tools (measurement properties, education required, and cost) in the context of their human and fiscal resources, in order to ensure that Best Practice Guidelines for Managing Dysphagia are implemented in an evidence-based manner.

Limitations / Disclaimer

This work is designed to provide information on evidence-based dysphagia screening to OSS regions. The members of the Dysphagia Screening Tool Working Group acknowledge that there may be limitations in this report which does not purport to be a comprehensive scholarly study. Readers are encouraged to review the literature prior to making any decisions about a specific dysphagia screening tool.

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Dysphagia Screening Tool Working Group – Appendix A

Rhonda McNicoll-Whiteman

Stroke Best Practice Coordinator
Central South Regional Stroke Program
Hamilton, ON

Angela South

Speech-Language Pathologist
London Health Sciences Centre
London, ON

Donelda Moscrip

Regional Speech-Language Pathologist
Central East Stroke Network
Barrie, ON

Meredith Wright

Chief, Speech-Language Pathology
The Ottawa Hospital
Ottawa, ON

Laura MacIsaac

Stroke Specialist Case Manager
Stroke Strategy for Southeastern Ontario
Kingston, ON

Cathy Corrigan-Lauzon

Formerly Regional Education Coordinator
Northeastern Ontario Stroke Network
Sudbury, ON

Alana MacIntryre

Best Practice Consultant
Sault Area Hospitals
Echo Bay, ON

Working Group Coordinator:

Linda LeDuc

Senior Specialist Professional Education
Ontario Stroke System
Toronto, ON

Dysphagia Screening Tool Evaluation Criteria- Appendix B

Tool	
What does the screen involve?	
Criteria	
• Type of study	Study design
• Reliability	The extent to which an observation that is repeated in the same, stable population yields the same result (i.e., test-retest reliability). Also, the ability of a single observation to distinguish consistently among individuals in a population. ⁽¹⁾
• Validity	The extent to which a measure accurately reflects the concept that it is intended to measure. ⁽¹⁾
• Sample size	The number of patients studied in a trial, including the treatment and control groups, where applicable. In general, a larger sample size decreases the probability of making a false-positive error (α) and increases the power of a trial, i.e., decreases the probability of making a false-negative error (β). Large sample sizes decrease the effect of random variation on the estimate of a treatment effect. ⁽¹⁾
• Population	What type of patients were used
• Level of Evidence	<p>From HSFO Best Practice Guidelines</p> <p>Level 1 evidence At least one prospective, randomized controlled study has found the intervention to be effective.</p> <p>Level 2 evidence At least one non-randomized cohort comparison, multicentre case-study series, or chronological series has found the intervention to be effective. Evidence may also be part of extraordinary results from randomized clinical trials.</p> <p>Level 3 evidence Canadian professional association guidelines, standard practice in other jurisdictions, descriptive studies, reports of an expert committee, collective experience of a consensus panel, or expert opinion have judged the intervention to be effective.</p>
• The strength of evidence	
• What type of program was tool tested in?	
• What objective measures were used to evaluate reliability?	How did researchers determine that the tool did or did not screen?
• What country was the tool developed and	

tested in?	
<ul style="list-style-type: none"> • Target population for tool 	Where on the stroke continuum and where in the health care system?
<ul style="list-style-type: none"> • Potential for regional implementation including personnel and cost requirements 	
<ul style="list-style-type: none"> • What training is required? 	
<ul style="list-style-type: none"> • Which professionals can perform the screen? 	
<ul style="list-style-type: none"> • Strengths of the tool 	
<ul style="list-style-type: none"> • Weaknesses of the tool 	

(1) United States National Library of Medicine, National Information Center on Health Services Research and Health Care Technology (NICHSR), HTA 101: Glossary (<http://www.nlm.nih.gov/nichsr/hta101/ta101014.html>)

Screening Tool	Level of Evidence	Type of Study	Sample	Validity	Reliability	Sensitivity / Specificity	Comments
Massey Bedside Swallowing Screen	Level 3	Prospective, one-group, non-experimental design	<p>A convenience sample of 25 adult, acute stroke patients admitted to a central Ohio acute care hospital.</p> <p>Criteria for inclusion: - at least 21 y.o. - admitting diagnosis of stroke or experienced a stroke following a procedure during hospitalization - ability to follow verbal or visual one-step commands - awake and able to respond to verbal or non-verbal cues;</p> <p>Sample included 16 males and 9 females</p>	Predictive validity was established through determination of sensitivity and specificity.	2 research assistants independently evaluated each participant within 2 hours. Inter-rater reliability for each item of the screen is high (>90%).	<p>Sensitivity to the presence of dysphagia = 100%</p> <p>Specificity to the presence of dysphagia = 100%</p>	<p>Sample was a convenience sample</p> <p>Small sample size</p> <p>Sample is taken from one centre.</p>
Timed Test of Swallowing and Questionnaire	Level 3	Prospective study	115 consecutive patients with acute stroke studied within 72 hours of admission to a large teaching hospital.	Predictive validity was assessed. Subjects with abnormal water test had increased relative risk of requiring dietary modification or intervention by SLP.	Reliability not established in the current study. Reliability data from previous studies cited within the article.	<p>Questionnaire had low sensitivity to dysphagia.</p> <p>Quantitative aspect of the water test: Sensitivity = 97% Specificity = 69%</p> <p>Qualitative aspect of the water test: Sensitivity = 73% Specificity = 67%</p>	<p>To score responses a comparison to normative data must be made which impacts on the simplicity of the tool.</p> <p>This tool requires a very specific administration protocol.</p>

Screening Tool	Level of Evidence	Type of Study	Sample	Validity	Reliability	Sensitivity / Specificity	Comments
Toronto Bedside Swallowing Screening Test (TOR-BSST®)	Level 1	Randomized controlled diagnostic study design with the gold standard being abnormality of the swallow physiology (including both inefficiency and aspiration) captured with videofluoroscopy	Total number of subjects was 311. Subjects were consecutive newly admitted with confirmed diagnosis of brainstem stroke or cerebellar stroke and all other stroke patients with NIH-SS score greater than or equal to 4. 103 acute (male 56.3%, female 43.7%; mean age 67.7 y; mean days post stroke, 6.1; mean NIHSS, 6.8; mean FIM 82.5) 208 rehabilitation (male 59.1%, female 40.9%; mean age, 69.0 y; mean days post stroke, 31.6; mean NIHSS 7.2; mean FIM 76.8)	Gold standard videofluoroscopic assessments by 4 separate blinded SLP expert raters were used to establish validity using 3 standardized scales.	Inter-rater reliability by trained nurse screeners was high with an ICC of 0.92 (95% CI, 0.85-0.96).	Overall sensitivity is 91.3% (71.9-98.7) and specificity is 66.7% (49.0-81.4) across all settings. Negative predictive values are 93.3% in acute patients and 89.5% in rehabilitation patients.	Standardized Education Model and training materials. Training for TOR-BSST® screeners must be completed by an SLP who has undergone “TOR-BSST® Training for the SLP Dysphagia Expert” course. TOR-BSST® is administered, scored and placed on the medical chart in approximately 10 minutes (less than 10 minutes for those patients who fail on an early item).
Screening Tool for Acute Neurological Dysphagia (STAND)	Information not available at this time.	Information not available at this time.	97 patients with acute stroke	Comparisons made against gold standard videofluoroscopy. Further information not available at this time.	Information on test-retest reliability is not available at this time.	Sensitivity for dysphagia = 92% Specificity for dysphagia = 60% Positive predictive value = .90 Negative predictive value = .60	

Screening Tool	Level of Evidence	Type of Study	Sample	Validity	Reliability	Sensitivity / Specificity	Comments
Standardized Swallowing Assessment (SSA)	Level 2	Validation study (Ellul et al., 1993)	156 acute stroke patients assessed within 48 hours of admission (20 were unconscious and could not be assessed)	Evidence to support the predictive validity of SSA. Risk ratio of lower respiratory tract infection in SSA potential aspirators = 4.0			
		Inter-rater reliability study (Ellul et al., 1996)	8 screeners (7 nurses, 1 nutritionist) assessing 9 acute stroke patients		Kappa values for agreement of raters in 2 groups on: Head control: 0.2; 0.19 Gag reflex: 0.8, 0.36 Wet voice: 0.32, 1 Swallowing safety: 0.64, 0.9 Additional Kappa values are available for pairs of raters grouped by amount of training received.		
		Longitudinal prospective survey (Perry, 2001a,b)	68 complete screening episodes of acute stroke patients by independently competent nurses	SSA demonstrates good agreement with summative clinical judgement of swallowing function (Kappa = 0.88)		Sensitivity for dysphagia: 97% Specificity for dysphagia: 90% Positive predictive value: 0.92 Negative predictive value: 0.96	Not all patients received the screening. Of the 41 screenable but unscreened patients only 2 were dysphagic. This sample bias means that the documented sensitivity/specificity of the SSA may be not be accurate.