Swallowing Screens After Acute Stroke
A Systematic Review
Sara K. Schepp, MD, MS; David L. Tirschwell, MD, MSc; Robert M. Miller, PhD; W.T. Longstreth, Jr, MD, MPH

Background and Purpose—Swallowing screens after acute stroke identify those patients who do not need a formal swallowing evaluation and who can safely take food and medications by mouth. We conducted a systematic review to identify swallowing screening protocols that met basic requirements for reliability, validity, and feasibility.

Methods—We searched MEDLINE and supplemented results with references identified through other databases, journal tables of contents, and bibliographies. All relevant references were reviewed and evaluated with specific criteria.

Results—Of 35 protocols identified, 4 met basic quality criteria. These 4 had high sensitivities of $\geq 87\%$ and high negative predictive values of $\geq 91\%$ when a formal swallowing evaluation was used as the gold standard. Two protocols had greater sample sizes and more extensive reliability testing than the others.

Conclusions—We identified only 4 swallowing screening protocols for patients with acute stroke that met basic criteria. Cost-effectiveness of screening, including costs associated with false-positive results and impact of screening on morbidity, mortality, and length of hospital stay, requires elucidation. (Stroke. 2012;43:00-00.)

Key Words: dysphagia ■ evaluation ■ screening ■ stroke ■ swallowing

Dysphagia affects 37% to 78% of patients with acute stroke and is associated with increased risk of aspiration, pneumonia, prolonged hospital stay, disability, and death.1 Because formal swallowing evaluation is neither possible nor warranted in all patients with acute stroke, the purpose of a swallowing screen is to identify those patients who do not need a formal evaluation and who can safely take food and medications by mouth. In this review, we addressed the following questions about swallowing screens after acute stroke: what standardized protocols have been described; how do protocols compare with respect to reliability, validity, and feasibility as defined by ease of training and administration; and what are the challenges of screening?

Materials and Methods
The search strategy and the inclusion and exclusion criteria for relevant articles identified are detailed in the Online Supplement (http://stroke.ahajournals.org). Information on study design, study size, and ease of training, administration, and scoring were sought but not required for inclusion. One of the authors (S.K.S.) conducted the search for articles and evaluated protocols with input from her coauthors. She is a former speech pathologist and current board-certified neurologist.

Results
Results of the search are summarized in the Figure and yielded 35 articles describing protocols. Thirty articles were excluded because they failed to meet $\geq 1$ of the required criteria as detailed in the Online Supplement.

The Table provides details on 4 protocols described in 4 articles and 1 abstract. Content of all 4 protocols included items previously shown to be important in identifying dysphagia and risk for aspiration.2-4 Two included assessment of mental status,2-4 whereas the other 2 protocols excluded subjects with diminished consciousness.5,6 All protocols included some assessment of oropharyngeal function, such as dysarthria, dysphonia, and asymmetry, or weakness of the face, tongue, and palate. All but one5 included assessment of ability to swallow water. The emergency physician screen4 included use of pulse oximetry in conjunction with water swallow. Extracts from the articles describing these protocols are included in the Online Supplement, except for the one that was proprietary.5

All protocols took place at tertiary care medical centers, although the Toronto Bedside Swallowing Screening Test6 was validated in 2 acute care and 2 rehabilitation hospitals. The emergency physician screen5 and the Modified Mann Assessment of Swallowing Ability4 were self-characterized as preliminary because of small sample sizes of 84 and 150 subjects, respectively. Furthermore, the Modified Mann Assessment of Swallowing Ability4 was only validated with administration by 2 neurologists. Training was described as

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simple and screenings took only minutes. None of the studies examined outcomes of pneumonia, prolonged hospital stay, disability, or death, aside from the study detailing the emergency physician screen, which reported incidence of pneumonia to be 6% in their cohort.5

Discussion

In this systematic review, only 4 swallowing screening protocols met basic criteria for reliability, validity, and feasibility. Despite our efforts, we may have missed a relevant article or inappropriately excluded one. This dearth of sound published screening protocols may have adversely affected broad implementation of early screening for all acute stroke patients.

All 4 screening protocols identified were published within the past 2 years, perhaps motivated by the previous Joint Commission requirement, which was subsequently dropped.9 Two of the 4 were promising but preliminary with small sample sizes.4,5 Of those remaining, the Barnes Jewish Hospital Stroke Dysphagia Screen (previously titled the Acute Stroke Dysphagia Screen, or ASDS)2,3 has 2 advantages over the Toronto Bedside Swallowing Screening Test.6 First, the Toronto Bedside Swallowing Screening Test was validated using videofluoroscopic swallowing study in a small random subsample (n=24) of those with acute stroke. The Barnes Jewish Hospital Stroke Dysphagia Screen was validated using videofluoroscopy in 225 patients with acute stroke, although these data have been presented only as an abstract thus far.3 Also, the Toronto Bedside Swallowing Screening Test is copyrighted, requiring purchase to be administered. Its purchase includes online training and information on how to implement the screening protocol, which may be desirable for some facilities.

Such studies face many challenges, perhaps explaining the small number of high-quality studies identified in this review. Ensuring that health care providers are sufficiently trained to administer a screen reliably any time of day or night is problematic. Screening that is performed at one time may be compared with a gold standard performed at a later time when dysphagia may have improved. Finally, we have not addressed the reliability of formal evaluations or their validity with respect to pneumonia, prolonged hospital stay, morbidity, and mortality.

Several observational studies suggest that screening may help prevent aspiration pneumonia10–12 but cannot distinguish

Table. Comparison of Swallowing Screening Protocols Meeting Basic Criteria

<table>
<thead>
<tr>
<th>Protocol (N)</th>
<th>Administration</th>
<th>Reliability*</th>
<th>Gold Standard and Validity†</th>
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</thead>
<tbody>
<tr>
<td>Barnes Jewish Hospital Stroke Dysphagia Screen2,3</td>
<td>By nurses, K=0.94</td>
<td>Sensitivity 91% (95% CI, 82–95), specificity 74% (95% CI, 64–80), PPV 54%, NPV 95%</td>
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</tr>
<tr>
<td>N=300 &amp; 225</td>
<td>2 min to administer,</td>
<td></td>
<td>Study 1: Dysphagia by MASA score &lt;178, N=300</td>
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<tr>
<td></td>
<td>10-min training</td>
<td></td>
<td>Study 2: Dysphagia on video-fluoroscopy, N=225</td>
</tr>
<tr>
<td>Modified Mann Assessment of Swallowing Ability4</td>
<td>By stroke neurologists, minutes K=0.76</td>
<td>Sensitivity 94% (95% CI, 88–98), specificity 66% (95% CI, 57–75), PPV 71%, NPV 93%</td>
<td></td>
</tr>
<tr>
<td>N=150</td>
<td>to administer, training</td>
<td></td>
<td>Dysphagia by MASA score &lt;178</td>
</tr>
<tr>
<td></td>
<td>time unknown</td>
<td></td>
<td>Examiner 1: Sensitivity 93% (95% CI, 82–98), specificity 86% (95% CI, 78–93), PPV 79%, NPV 95%</td>
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<tr>
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<td>Examiner 2: Sensitivity 87% (95% CI, 75–95), specificity 84% (95% CI, 75–91), PPV 76%, NPV 92%</td>
</tr>
<tr>
<td>Emergency Physician Swallowing Screening5</td>
<td>By emergency physicians, K=0.90</td>
<td>Sensitivity 96% (95% CI, 85–99), specificity 56% (95% CI, 38–72), PPV 74%, NPV 91%</td>
<td></td>
</tr>
<tr>
<td>N=84</td>
<td>≤3 min to administer, training unknown</td>
<td></td>
<td>Dysphagia on formal swallowing evaluation</td>
</tr>
<tr>
<td>Toronto Bedside Swallowing Screening Test6</td>
<td>By nurses, ICC=0.92</td>
<td>Sensitivity 96% (95% CI, 73–99), specificity 64% (95% CI, 35–85), PPV 77% (95% CI, 53–90), NPV 93% (95% CI, 58–99)</td>
<td></td>
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<tr>
<td>N=311</td>
<td>4-hr training</td>
<td></td>
<td>Dysphagia on videofluoroscopy (acute patients)</td>
</tr>
</tbody>
</table>

*Inter-rater reliability; K indicates kappa; ICC, intra-class correlation coefficient.
†MASA indicates Mann Assessment of Swallowing Ability; CI, confidence interval; PPV, positive predictive value; NPV, negative predictive value.
whether lower frequency of pneumonia is attributable to the use of a swallowing screen itself or to other characteristics of a medical center. Also, these studies used a variety of different formal and informal screening techniques. Placebo-controlled randomized trials in high-volume stroke centers may be difficult to conduct now that swallowing screening has become common practice. Alternatively, the effectiveness of different screening strategies could be evaluated.

Further research is particularly needed to evaluate cost-effectiveness of swallowing screening in this population. Potential benefit may be seen not only in terms of pneumonia but also in terms of length of hospital stay, morbidity, and mortality. But screening has risks attributable to false-positive results, which may lead to unnecessary withholding of oral feeding or placement of feeding tubes. The positive predictive values of protocols we reviewed ranged from 54% to 77%. Thus, 23% to 46% of patients screened were falsely identified as having increased risk.

Finally, effective screening depends not only on careful analysis of costs and benefits but also on availability of effective interventions for those identified as being at high risk. Once reliability, validity, and feasibility of swallowing screens and formal swallowing evaluations are established, effectiveness of interventions needs to be addressed. Only through such efforts will the use of swallowing screens in patients after acute stroke be established as evidence-based.

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Disclosures
None.

References
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Swallowing Screens after Acute Stroke: A Systematic Review

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Search Strategy

The primary search was conducted through MEDLINE using the terms (swallow* OR dysphagia) AND (screening OR evaluation OR assessment) AND (stroke OR cerebrovascular accident) with no limits through August 12, 2011. Only publications in English were considered. Additional papers were identified through (1) search of CINAHL and EMBASE databases over the same time period using the same search terms, (2) review of relevant papers’ references, (3) manual search of the tables of contents for the Journals Stroke and Dysphagia from January 2005 to August 2011, (4) search of reference lists for guidelines publications, and (5) search of the Cochrane Library.

Supplemental Table 1: Criteria used to evaluate swallowing-screening protocols

<table>
<thead>
<tr>
<th>Criterion</th>
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<tr>
<td>5</td>
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<tr>
<td>6</td>
</tr>
</tbody>
</table>
Relevant papers that were excluded (see Figure 1)

Excluded due to need for specialized training or expertise for administration (n=3)

1. Kagaya H, Okada S, Saitoh E, Baba M, Yokoyama M, Takahashi H. Simple swallowing provocation test has limited applicability as a screening tool for detecting aspiration, silent aspiration, or penetration. Dysphagia. 2010;25:6-10

Excluded due to unclear description of gold standard criterion, validation against something other than a swallowing assessment, or insufficient reporting of validation (n=11)


We could not be sure that all patients received formal swallowing evaluation against which validity could be determined. Nevertheless, this swallowing screen, conducted by emergency department nurses, had many merits. It was simple, consisted of five items, and was evaluated in a sample of 283 patients with acute stroke. Inter-rater reliability was substantial with kappa = 0.69 (95% CI 0.55-0.83). For the heterogeneous gold standard that was used, sensitivity was 95% (95% CI 88-98), specificity was 55% (95% CI 48-62), positive predictive value was 50% and negative predictive value was 95%

9. Tanton M. Developing a screening tool and training package to identify dysphagia in all
settings. Nurs Times. 2010;106:18-20

Excluded due to lack of reliability data (n=16)

6. Hinds NP, Wiles CM. Assessment of swallowing and referral to speech and language therapists in acute stroke. QJM. 1998;91:829-835
Details on how to perform swallowing screens, extracted from the references

Barnes Jewish Hospital Stroke Dysphagia Screen (previously titled the Acute Stroke Dysphagia Screen, ASDS)


STROKE DYSPHAGIA SCREEN

Date: _______________

To be completed on all patients upon admission with diagnosis of stroke. If any of the following questions are answered with a yes, stop and refer to speech pathology.

1) Is the Glasgow Coma Scale LESS than 13? □ YES □ NO
2) Is there Facial Asymmetry/Weakness? □ YES □ NO
3) Is there Tongue Asymmetry/Weakness? □ YES □ NO
4) Is there Palatal Asymmetry/Weakness? □ YES □ NO
5) Are there signs of aspiration during the 3 oz water test? □ YES □ NO

➢ If all findings for the first 4 questions are NO, proceed to the 3 oz water test.

➢ Administer 3 oz of water for sequential drinks, note any throat clearing, cough or change in vocal quality immediately after and 1 minute following the swallow. If clearing, coughing or change in vocal quality is noted, refer to speech therapy.

➢ If all of the answers to the above questions are NO, then start the patient on a regular diet.

R.N. signature

Assessment methodology and form developed by Barnes Jewish Hospital, Speech Pathology Services © 2006, All Rights Reserved
Modified Mann Assessment of Swallowing Ability (MMASA)


Appendix: Dysphagia Screen

Modified Mann Assessment of Swallowing Ability (MMASA)

INSTRUCTIONS:
Circle the most appropriate clinical findings for each indicator.
Calculate the total score by adding the points for each indicator.

Patient Name__________________________
Date__________________________

1. Alertness
Task: Observe and evaluate the patient’s response to speech, limb movement, or painful stimulation
Grade:
10 = Alert
8 = Drowsy fluctuating awareness/alert level
5 = Difficult to arouse by speech or movement
2 = Coma or nonresponsive

2. Cooperation
Task: Gain patient’s attention and attempt to initiate communication or activity
Grade:
10 = Cooperative—engages in some form of verbal or nonverbal exchange
8 = Fluctuating co-operation
5 = Reluctant co-operation
2 = No co-operation/response

3. Respiration
Task: Assess status of patient’s respirations
Grade:
10 = Chest clear, no clinical or radiographic evidence of abnormality
8 = Spum in the upper airway or other respiratory condition (e.g., asthma/bronchopulmonary, chronic obstructive pulmonary disease)
6 = Fine basal crepitations/self-clearing
4 = Coarse basal crepitations
2 = Suspected infection/frequent suctioning/respirator dependent

4. Expressive Dysphagia
Task: Assess for disturbances in expression
Grade:
5 = No abnormality
4 = Mild difficulty finding words/expressing ideas
3 = Expresses self in a limited manner/short phrases or words
2 = No functional speech sounds or inaudible single words
1 = Unable to assess

5. Auditory Comprehension
Task: Ability to understand basic verbal communication
Grade:
10 = No abnormality
8 = Follows ordinary conversation with little difficulty
6 = Follows simple conversation/instructions with repetition
4 = Occasional response if cued
1 = No response

6. Dysarthria
Task: Assess articulation
Grade:
5 = No abnormality
4 = Slow with occasional hesitation and slurring
3 = Speech intelligible but obviously defective rate/range/ articulation
2 = Speech unintelligible
1 = Unable to assess
7. Saliva
Task: Observe patient’s control of saliva; note any escape of secretions from the side of the mouth

Grade:
5 = No abnormality
4 = Prosthesis/retainers used
3 = Drooling at times, during speech, while side lying or fatigued
2 = Some drool consistently
1 = Gross drooling, unable to control drooling

8. Tongue Movement
Task: Assess tongue movement
Protrusion: Have patient extend tongue as far forward as possible, and then retract
Lateralization: Have patient touch each corner of the mouth, then repeat alternating lateral movements
Elevation: With mouth wide open, have patient raise tongue up to palate; alternate elevation and depression in this way

Grade:
10 = Full range of movement/absence of abnormality detected
9 = Mild impairment in range
8 = Moderate impairment
7 = Severe impairment
6 = Incomplete movement
5 = Minimal movement
4 = No movement or unable to perform

9. Tongue Strength
Task: Assess bilateral tongue strength
Have patient push laterally and anteriorly against tongue blade

Grade:
10 = No abnormality
9 = Minimal weakness
8 = Obvious unilateral weakness
7 = Gross weakness or unable to perform

10. Gag
Task: Contact posterior pharyngeal wall on either side separately

Grade:
10 = No abnormality
9 = Diminished bilaterally
8 = Diminished unilaterally
7 = Absent bilaterally
6 = Absent unilaterally
5 = No gag response

11. Cough Reflex
Task: Ask patient to cough as strong as possible
Observe strength and clarity of cough

Grade:
10 = No abnormality
9 = Cough attempted, but hoarse in quality
8 = Cough attempted, but weak
7 = Cough attempted, but inadequate
6 = Attempt to cough
5 = No attempt or unable to perform

12. Palate
Task: Ask patient to produce a strong “AH” several times and sustain each one for several seconds
Observe for hypernasality and note action of palate elevation

Grade:
10 = No abnormality
9 = Slight asymmetry noted; mobile palate
8 = Slight asymmetry noted; mobile palate
7 = Inconsistently maintained
6 = Unilaterally weak and inconsistently maintained
5 = Minimal movement, nasal regurgitation; nasal air escape
4 = Minimal movement, nasal regurgitation; nasal air escape
3 = No elevation of palate or unable to perform

MMSAS SCORE =

Interpretation:
Score ≥ 95: Start oral diet and progress as tolerated. Monitor first oral intake and consult SPEECH PATHOLOGY if patient has difficulty eating or drinking.

Score ≤ 94: Nothing by mouth and consult SPEECH PATHOLOGY for a formal swallow evaluation.
A swallowing screen conducted by emergency physicians

Toronto Bedside Swallowing Screening Test (TOR-BSST)


Proprietary but items assess vocal quality, tongue movement, water swallow.