

# Review of the Current Science of Dysphagia Screening

Stephanie K. Daniels, PhD, CCC, BRS-S

University of Houston

Michael E. DeBakey VAMC

# Dysphagia and Stroke: Demographics

- 2000 people per million worldwide
- 700,000 individuals annually in U.S.
- Dysphagia occurs in ~55% of acute stroke patients
- 40% demonstrate aspiration on VFSS
- 40%-70% demonstrate silent aspiration

# Screening of Swallowing

- Swallowing involves a distributed neural network
- We cannot use lesion localization to predict who will have dysphagia
- We cannot determine risk of dysphagia by patient complaints
- Thus, individuals with presenting with stroke symptoms must have swallowing screened

# Screening of Swallowing

- Screening-quick, minimally invasive evaluation to determine
  - Likelihood of dysphagia
  - Needs further swallowing assessment
  - Safe to feed patient orally (for purposes of nutrition, hydration, and medication administration)

# Screening of Swallowing

- Implementation of dysphagia screening results in ↓ LOS, morbidity, and costs (Hinchey et al., 2005; Odderson et al., 1993)
- Earlier administration of first dose of aspirin in hospitals using a swallowing screening tool (Power et al., 2007)

# Screening of Swallowing

- ASA/AHA guidelines-swallowing should be screened prior to oral intake
- VHA guideline to screen swallowing in all individuals admitted with stroke symptoms
- UK's National Institute for Clinical Excellence-screening of swallowing w/in 4 hours of admission for acute stroke patients

# Screening of Swallowing

- No consensus on screening tool thus removed from the Joint Commission's stroke guidelines (Lakshminarayan et al., 2010)
  - Removal from the Joint Commission recommendations does not mean to stop screening

# Screening of Swallowing

- Controversy concerning screening
- Who should screen?
  - Nurses?
  - SLPs?
  - MDs?
- What type of screening tool should be used?
  - Non-swallowing behaviors?
  - Water swallow test (WST)?
  - Both?

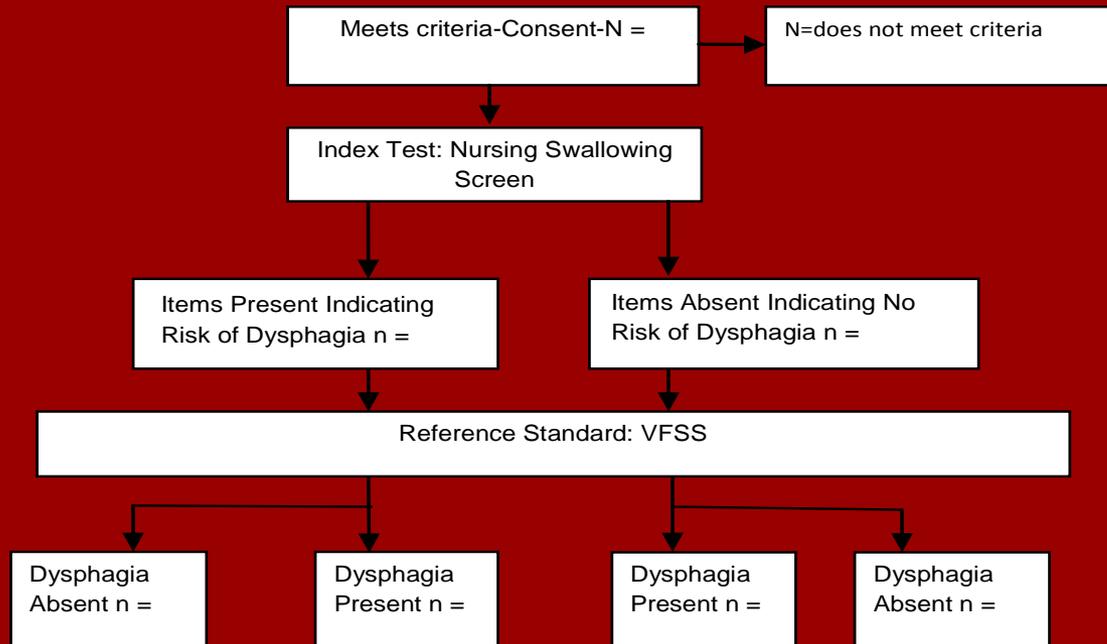
# Screening of Swallowing

- No consensus on screening tool
  - Constructing and implementing screening tools without validation
  - Adopting published screening without close review

# Screening of Swallowing

- Guidelines to assessing quality and reporting of screenings
  - Cochrane (Reitsma et al., 2009)
  - Quality Assessment for Diagnostic Accuracy of Studies (QUADAS) (Whiting et al., 2003)
  - Sackett et al. (1991)
  - Standards for Reporting Diagnostic Test Accuracy (STARD) (Bossuy et al., 2004)

# Screening of Swallowing



# Screening of Swallowing

- A whole host of screenings available
- Must consider:
  - Validation-compared against a gold-standard instrumental evaluation
    - Sensitivity
    - Specificity
  - Time period between screen and gold-standard
  - Patients-consecutive versus referrals
  - Blinding of examiners completing screening and instrumental examination

# Screening of Swallowing

- A whole host of screenings available
- Must consider:
  - Reliability
  - Feasibility, particularly if nurse or MD administering

# Screening of Swallowing

- Sensitivity: the probability that a diagnostic sign (e.g. cough after swallow) will be present given that the disease (dysphagia) is truly present (true positive)
  - Diagnostic sign absent but disease is present—FALSE NEGATIVE
- Specificity: the probability that a diagnostic sign will be absent given that the disease is truly absent (true negative)
  - Diagnostic sign present but disease is absent—FALSE POSITIVE

# Screening of Swallowing

- Screenings should have both high sensitivity and high specificity
- Most screenings focus on high sensitivity due to increased morbidity and mortality
- Have sacrificed specificity for sensitivity but to what expense?
  - Delay in receipt of oral intake including medication
  - Unwarranted placement of NGTs
    - ↑ morbidity with NGT placement in acute stroke (Langdon et al., 2009)

# Screening of Swallowing

- Numerous screening tools developed over the past 5 years
- No tool has achieved consensus as a standard screening tool

# Screening of Swallowing

- Toronto Bedside Swallowing Screening Test TOR-BSST<sup>©</sup> (Martino et al., 2009)
  - Screening specific for stroke
    - Acute
    - Post-acute
  - Administered by trained nurses
    - SLP trained by Toronto group
    - Nurse trained by SLP-4 hours
  - Non-swallowing and swallowing items
    - Do not proceed to swallowing if any non-swallowing item is present

# Screening of Swallowing

- Toronto Bedside Swallowing Screening Test TOR-BSST<sup>©</sup> (Martino et al., 2009)
  - Assessment of vocal quality (dysphonia, tongue symmetry, and water swallows)
    - Water swallow: 10 individual teaspoons-cough, change in vocal quality
  - If fail any single item, screening is stopped and patient is NPO until SLP evaluation
  - If pass entire test, oral intake is initiated

# Screening of Swallowing

- TOR-BSST © (Martino et al., 2009)
  - N = 311 patients with confirmed stroke
    - n = 103 acute
    - n = 208 rehabilitation
  - Validated against VFSS
    - Outcome: dysphagia
    - Completed w/in 24 hours of screening
  - Only 1 in 5 patients randomized to VFSS
  - SLP blinded to nursing screening results

# Screening of Swallowing

- TOR-BSST<sup>©</sup> (Martino et al., 2009)
  - Reliability-ICC-92% (first 50 patients)
  - Sensitivity-91%
  - Specificity-67%

# Screening of Swallowing

- TOR-BSST © (Martino et al., 2009)
- Strengths
  - High sensitivity
  - Designed for nurses and reliability obtained for nurses
  - Outcome was dysphagia NOT just aspiration
  - Items based on literature review
  - Rigorous documented methodological procedures
    - All exclusions explained

# Screening of Swallowing

- TOR-BSST © (Martino et al., 2009)
- Weaknesses
  - Low specificity
  - Literature review not current
    - through July 1997
  - Only 19% of the subjects contributed to the validation piece
  - Majority were from rehabilitation settings, not acute stroke
  - Excluded individuals with mild stroke
    - NIH-SS <4

# Screening of Swallowing

- TOR-BSST<sup>©</sup> (Martino et al., 2009)
- Weaknesses
  - Up to 24 hour between tests
  - Dysphagia not operationally defined
  - Reliability not obtained throughout study
  - Feasibility
    - Up to 10 minutes to complete
    - 4 hours of training
    - Full screening protocol not available unless trained
    - Fee involved with acquiring the tool and education components
      - \$500 CDN

# Screening of Swallowing

- 3-oz water swallow test (WST) (Suiter & Leder, 2008)
  - Screening for all patients regardless of DX
  - Discipline of screener not stated
    - SLP in articles
  - Single swallowing item

# Screening of Swallowing

- 3-oz WST (Suiter & Leder, 2008)
  - Patients given 90 ml of water to swallow without interruption
  - Fail if:
    - Cough/choking up to 1 min after completion
    - Wet hoarseness after swallowing
    - Unable to complete without interruption

# Screening of Swallowing

- 3-oz WST (Suiter & Leder, 2008)
  - N = 3000 patients-heterogeneous population
    - Referral to speech pathology
  - Tested against videoendoscopy
    - Outcome: aspiration
    - Screening completed immediately after videoendoscopy
  - Same examiner performed videoendoscopy and screening

# Screening of Swallowing

- 3-oz WST (Suiter & Leder, 2008)
  - No reliability data
  - Sensitivity-97%
  - Specificity-49%

# Screening of Swallowing

- 3-oz WST (Suiter & Leder, 2008)
- Strengths
  - High sensitivity
  - Rapid test and single item—Suggests high feasibility and reliability
  - Validated in heterogeneous population, suggesting it is good in screening all populations
  - No delay in completion of screening and reference standard

# Screening of Swallowing

- 3-oz WST (Suiter & Leder, 2008)
- Weaknesses
  - Low specificity
  - No blinding
    - Same person who completed videoendoscopy completed screening
    - Cannot R/O bias
  - Outcome was aspiration
  - Heterogeneous population
    - Validity for specific subpopulation?

# Screening of Swallowing

- 3-oz WST (Suiter & Leder, 2008)
- Weaknesses
  - Patients self-regulating large volumes
  - More recent study, patients excluded if determined unsafe (videoendoscopy) to complete 3-oz water swallow test (Leder et al., 2010)
    - No information on morbidity of 3-oz water swallow test

# Screening of Swallowing

- 3-oz WST (Suiter & Leder, 2008)
- Weaknesses
  - No reliability data
    - Can other disciplines reliably administer and interpret?

# Screening of Swallowing

- 3-oz WST-stroke cohorts
  - Instructed to drink water (90 ml) w/out stopping
  - Positive for aspiration if coughing or wet vocal quality for up to 1 minute after ingestion
- Findings
  - Identified 80% of patients w/ aspiration on VFSS (DePippo et al., 1992)
  - Identified 30% of patients w/ aspiration on VFSS (Garon et al., 1995)

# Screening of Swallowing

- Gugging Swallowing Screen-GUSS (Trapl 2007)
  - Screening for acute stroke patients
  - Administration by nurse or SLP
  - Indirect and direct items
    - Do not proceed to direct swallowing items if indirect swallowing items abnormal

# Screening of Swallowing

- Gugging Swallowing Screen (Trapl 2007)
  - Indirect swallowing
    - Vigilance-stay alert for a minimum of 15 min
    - Volitional cough/throat clear x2
    - Saliva swallow
      - Swallow successfully-effectual laryngeal elevation
      - No drooling
      - No voice change
    - Must achieve maximum score of 5 to proceed

# Screening of Swallowing

- Gugging Swallowing Screen (Trapl 2007)
  - Direct swallowing section
    - Maximum score of 20
      - GUSS score  $\leq$  14-15 indicates risk of aspiration
    - Semi-solid trial-water thickened w/ instant food thickener
      - Start with  $\frac{1}{2}$  teaspoon
      - If no symptom, 3-5 teaspoons
    - Liquid-water
      - Start with 3 ml, increase to 5 ml, 10 ml, 20 ml and then 50 ml as fast as possible

# Screening of Swallowing

- Gugging Swallowing Screen (Trapl 2007)
  - Direct swallowing section
    - Solid-dry bread
      - Six individual small pieces
    - Stop any section if the following are observed:
      - Deglutition
        - Swallowing not possible
        - Swallowing delayed (>2 sec; >10 sec with solids)
      - Cough
      - Drooling
      - Voice Change

# Screening of Swallowing

- Gugging Swallowing Screen (Trapl 2007)
  - N = 19 acute stroke patients
    - GUSS completed by SLP-reliability assessed
  - N = 30 acute stroke patients
    - GUSS completed by trained nurses-no reliability
  - Validated against videoendoscopy
    - Outcome: risk of aspiration (PAS 4/5)
    - Same day completion for screening and endoscopy but time frame not stated

# Screening of Swallowing

- Gugging Swallowing Screen (Trapl 2007)
  - Blinding of examiners
  - Reliability-95% agreement
  - Validation for SLP
    - Sensitivity-100%
    - Specificity-50%
  - External validation with nurses
    - Sensitivity-100%
    - Specificity-69%

# Screening of Swallowing

- Gugging Swallowing Screen (Trapl 2007)
- Strengths
  - High sensitivity
  - Focused on acute stroke
  - Blinding of examiners
  - High reliability for SLPs

# Screening of Swallowing

- Gugging Swallowing Screen (Trapl 2007)
- Weaknesses
  - Low specificity
  - Small samples size
  - Outcome was risk of aspiration
  - Difficult to discern administration and interpretation of screening
    - Not objective measures
    - Limits ability to replicate
  - Reliability not obtained in nurses

# Screening of Swallowing

- Gugging Swallowing Screen (Trapl 2007)
- Weaknesses
  - No training stated
  - Time frame between tests not stated
  - Obtainment of items
    - No report of literature review

# Screening of Swallowing

- Gugging Swallowing Screen (Trapl 2007)
- Weaknesses
  - Feasibility
    - Numerous consistencies and volumes
    - Time to administer?
    - Can nursing be trained in administration and interpretation and maintain skills

# Screening of Swallowing

- Acute Stroke Dysphagia Screen –ASDS  
(Edamiaston, 2009)
  - Acute stroke patients
  - Administered by nurses
    - Training of nurses 10 minutes
  - Non-swallowing and swallowing items
    - Do proceed to swallowing item if abnormal non-swallowing item

# Screening of Swallowing

- Acute Stroke Dysphagia Screen –ASDS  
(Edmiaston, 2009)
  - Non-swallowing
    - GCS <13
    - Facial asymmetry/weakness
    - Tongue asymmetry/weakness
    - Palatal asymmetry/weakness
  - Any present, stop and consult SLP

# Screening of Swallowing

- Acute Stroke Dysphagia Screen –ASDS  
(Edmiaston, 2009)
  - Swallowing
    - 3-oz WST
      - Throat clear
      - Cough
      - Voice change
  - Any present, consult SLP

# Screening of Swallowing

- Acute Stroke Dysphagia Screen –ASDS  
(Edmiaston, 2009)
  - N = 300 stroke patients
  - Tested against MASA administered by SLP
    - Outcomes: dysphagia and aspiration
    - Blinding of examiners
  - Time frame: 32 hours
  - Sensitivity-91%-dysphagia, 95% aspiration
  - Specificity-74%-dysphagia, 68% aspiration
  - Reliability-k = 93.6

# Screening of Swallowing

- Acute Stroke Dysphagia Screen –ASDS  
(Edmiaston, 2009)
- Strengths
  - High sensitivity
  - Outcomes were dysphagia and aspiration
  - Nursing-administered
  - Blinding
  - Feasible
    - Brief examination
    - Short training period

# Screening of Swallowing

- Acute Stroke Dysphagia Screen –ASDS  
(Edmiaston, 2009)
- Weaknesses
  - Low specificity
  - Reference standard was not an instrumental examination
  - Length of time between examination

# Screening of Swallowing

- Acute Stroke Dysphagia Screen –ASDS  
(Edmiaston, 2009)
- Weaknesses
  - Operational definitions of non-swallowing items not provided
  - Reliability was not established with live patients
    - After training, scored video
    - Maintenance of reliability unknown

# Screening of Swallowing

- ED Physician Dysphagia Screening (Turner-Lawrence, 2009)
  - Screening for acute stroke patients
  - Designed to be administered by MDs in ED
  - Non-swallowing and swallowing items
    - Do not proceed to swallowing item if abnormal non-swallowing item

# Screening of Swallowing

- ED Physician Dysphagia Screening (Turner-Lawrence, 2009)
  - Tier 1: non-swallowing
    - C/O dysphagia
    - Abnormal vocal quality
    - Facial asymmetry
    - Expressive or receptive aphasia
  - If any item present, do not proceed to Tier 2

# Screening of Swallowing

- ED Physician Dysphagia Screening (Turner-Lawrence, 2009)
  - Tier 2: swallowing
  - 10 ml WST
    - Cough
    - Voice change
    - Monitored PO during and for 2 minutes after WST
      - Decrease > 2%
    - Any present, failed Tier 2

# Screening of Swallowing

- ED Physician Dysphagia Screening (Turner-Lawrence, 2009)
  - N = convenience sample of 84 acute stroke patients
    - Within 24 hours of symptom onset
      - 727 patients d/c with stroke during same time period
  - Validated against standardized dysphagia assessment by SLP
    - Outcome: modified diet
    - Approximately 12 hours between tests

# Screening of Swallowing

- ED Physician Dysphagia Screening (Turner-Lawrence, 2009)
  - Reliability-completed in 32 patients
    - Patients who failed Tier 1 in first screening did not receive Tier 2 in second screening
  - Reliability Agreement 97%
  - Sensitivity-96%
  - Specificity 56%

# Screening of Swallowing

- ED Physician Dysphagia Screening (Turner-Lawrence, 2009)
- Strengths
  - High sensitivity
  - Tested in ED, which is ideal place for screening individuals with stroke symptoms
  - Completed by ED attending physicians and residents
  - High reliability

# Screening of Swallowing

- ED Physician Dysphagia Screening (Turner-Lawrence, 2009)
- Weaknesses
  - Low specificity
  - No operational definitions of screening items
    - Limits replication
  - Non-instrumental reference standard
    - Judgment of diet varies between clinicians
  - Use of pulse oximetry
    - > 2% decrease in O<sub>2</sub> within normal variations

# Screening of Swallowing

- ED Physician Dysphagia Screening (Turner-Lawrence, 2009)
- Weaknesses
  - Training procedure for MDs not stated
  - Extended time between tests
    - Acute stroke patients can change rapidly
  - Obtainment of items
    - No report of literature review
  - Small sample size

# Screening of Swallowing

- ED Physician Dysphagia Screening (Turner-Lawrence, 2009)
- Weaknesses
  - Convenience sample
    - 727 patients d/c with stroke during same time period
    - Bias cannot be R/O

# Screening of Swallowing

- Modified Mann Assessment of Swallowing Ability-MMASA (Antonios, 2010)
  - Screening for acute stroke patients
  - Physician administered
    - Evaluated administration and reliability in stroke neurologists
  - Non-swallowing items only

# Screening of Swallowing

- Modified Mann Assessment of Swallowing Ability-MMASA (Antonios, 2010)
  - Used 12 of 24 items from MASA
    - Alertness
    - Cooperation
    - Respiration
    - Expression
    - Comprehension
    - Dysarthria
    - Saliva control

# Screening of Swallowing

- Modified Mann Assessment of Swallowing Ability-MMASA (Antonios, 2010)
  - Used 12 of 24 items from MASA (cont.)
    - Tongue movement
    - Tongue strength
    - Gag
    - Volitional cough
    - Palate movement

# Screening of Swallowing

- Modified Mann Assessment of Swallowing Ability-MMASA (Antonios, 2010)
  - Maximum score 100
  - Scores  $\leq 94$  indicates need for SLP assessment, patient NPO

# Screening of Swallowing

- Modified Mann Assessment of Swallowing Ability-MMASA (Antonios, 2010)
  - N = 150 consecutive acute stroke
  - Tested against MASA administered by SLP
    - Outcome: dysphagia
    - Time frame: 2 hours
  - Blinding of examiners

# Screening of Swallowing

- Modified Mann Assessment of Swallowing Ability-MMASA (Antonios, 2010)
  - Reliability-agreement between neurologists
    - $K=.76$
    - 98% dysphagia/no dysphagia
  - Sensitivity-92%, 87%
  - Specificity-86%, 84%

# Screening of Swallowing

- Modified Mann Assessment of Swallowing Ability-MMASA (Antonios, 2010)
- Strengths
  - High sensitivity and high specificity
  - Outcome was dysphagia
  - Rigorous method to identify items
  - Good reliability between MDs
  - Little delay between screening and reference standard

# Screening of Swallowing

- Modified Mann Assessment of Swallowing Ability-MMASA (Antonios, 2010)
- Strengths
  - Operational definitions for item scoring
  - Blinding
  - Completed by MDs

# Screening of Swallowing

- Modified Mann Assessment of Swallowing Ability-MMASA (Antonios, 2010)
- Weaknesses
  - Not compared against instrumental examination
  - Overlap in items on screening and reference standard
  - Training of MDs not specified
    - MDs were stroke neurologists
      - Residents?, non-stroke MDs?

# Screening of Swallowing

- Modified Mann Assessment of Swallowing Ability-MMASA (Antonios, 2010)
- Weaknesses
  - Length to administer not specified
  - Feasibility
    - Training and maintenance in administration and interpretation

# Screening of Swallowing

- NIHSS (Bravada, 2010)
  - Retrospective chart review
  - Compared nonvalidated nursing screening tool with NIHSS
  - Nursing screening-11 items-non-swallowing and swallowing
    - If item present, d/c screening
    - Nurses did not routine administer provide water/food as part of screening
    - Completed online educational program

# Screening of Swallowing

- NIHSS (Bravada, 2010)
  - Dysphagia determined by SLP consultation report
  - Stroke severity per MD with NIHSS
    - Dichotomized  $<2 / >2$
  - Nurse screening
    - Sensitivity-29%
    - Specificity-84%
  - NIHSS
    - Sensitivity-79%
    - Specificity-68%

# Screening of Swallowing

- Where are we now and where do we need to go?
  - Screening of swallowing in stroke is critical
  - Many screening tools available, but no consensus
  - Most with only high sensitivity
    - Is both high sensitivity and high specificity unrealistic?

# Screening of Swallowing

- Where are we now and where do we need to go?
  - Appears nursing administration of water swallow trials is feasible
    - Pilot study at MEDVAMC ED
  - Reliability of implementation and interpretation over time remains unknown
  - More work on facilitating implementation required