A Simple Bedside Stroke Dysphagia Screen, Validated against Videofluoroscopy, Detects Dysphagia and Aspiration with High Sensitivity

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Background: Early identification of dysphagia is associated with lower rates of pneumonia after acute stroke. The Barnes–Jewish Hospital Stroke Dysphagia Screen (BJH-SDS) was previously developed as a simple bedside screen performed by nurses for sensitive detection of dysphagia and was previously validated against the speech pathologist's clinical assessment for dysphagia. In this study, acute stroke patients were prospectively enrolled to assess the accuracy of the BJH-SDS when tested against the gold standard test for dysphagia, the videofluoroscopic swallow study (VFSS). *Methods:* Acute stroke patients were prospectively enrolled at a large tertiary care inpatient stroke unit. The nurse performed the BJH-SDS at the bedside. After providing consent, patients then underwent VFSS for determination of dysphagia and aspiration. The VFSS was performed by a speech pathologist who was blinded to the results of the BJH-SDS. Sensitivity and specificity were calculated. Pneumonia rates were assessed across the 5-year period over which the BJH-SDS was introduced into the stroke unit. *Results:* A total of 225 acute stroke patients were enrolled. Sensitivity and specificity of the screen to detect dysphagia were 94% and 66%, respectively. Sensitivity and specificity of the screen to detect aspiration were 95% and 50%, respectively. No increase in pneumonia was identified during implementation of the screen ($P = .33$). *Conclusion:* The BJH-SDS, validated against videofluoroscopy, is a simple bedside screen for sensitive identification of dysphagia and aspiration in the stroke population. **Key Words:** Stroke—dysphagia—pneumonia—aspiration—screening test.

Introduction

Dysphagia is a well-recognized complication of both acute ischemic and hemorrhagic stroke. Its prevalence varies depending on the method and timing of the evaluation, affecting between 37% and 78% of acute stroke patients.[1,2] Poststroke dysphagia is independently associated with pneumonia; the latter is known to significantly increase the burden of stroke, by causing greater morbidity, mortality, and health-care costs.[2-4] Formal dysphagia screening protocols have been associated with significant reductions in pneumonia risk following stroke.[5,6]

The Barnes–Jewish Hospital Stroke Dysphagia Screen (BJH-SDS) was developed in 2006 as a simple bedside tool for identifying dysphagia in the stroke unit at Barnes–Jewish Hospital.[7] Before 2006, the speech language

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pathologist (SLP) was required to evaluate every stroke patient in the hospital for possible dysphagia. Such requirements were not only time and labor intensive for the hospital's speech therapy service but also resulted in numerous patients being kept without food for an unnecessarily long period. In our previous study, the BJH-SDS demonstrated simplicity (timed to take less than 2 minutes on average) and high intra- and inter-rater reliability (94% and 92%, respectively) among hospital nurses.[7] It was also found to have high sensitivity and moderate specificity when validated against the clinical bedside swallow test, the Mann Assessment Swallowing Ability (MASA).[8]

Given the promising early findings of the BJH-SDS regarding its simplicity, reliability, and accuracy when tested against the MASA, the next step and aim of the present study were to validate the BJH-SDS against the gold standard for dysphagia and aspiration detection, the videofluoroscopic swallow study (VFSS). A secondary aim was to evaluate rates of pneumonia over the period the BJH-SDS was introduced into the stroke unit to assess for any compromise in patient safety during screen implementation.

Methods

Data Collection and Administration of the BJH-SDS

The study was approved by the institutional review board to ensure ethical conduct of research studies with human participants. Written informed consent was obtained in all participants. Acute stroke patients were prospectively enrolled from the Barnes–Jewish Hospital inpatient stroke service (an urban, tertiary care referral center admitting 1300 stroke patients annually). Criteria for inclusion were clinical diagnosis of stroke (either ischemic or hemorrhagic) and age of 18 years or older. Patients with decreased level of alertness preventing participation in the VFSS (defined as a score of 2 on the "Alertness" component of the MASA) were excluded. Patients with physical limitations preventing the ability to sit upright (eg, intubation or if the treating physician had ordered the patient to have the head of the bed flat) were excluded. Patients with confirmed or suspected pregnancy were excluded. The components of the BJH-SDS (Fig 1) were chosen based on several guiding principles including ease of administration, ease of interpretation (objective rather than subjective findings), and pre-existing research supporting each item's relationship to dysphagia. The rationale supporting the design of the BJH-SDS was provided in the previous study.[7]

After the patient was admitted to the stroke unit, the patient's nurse administered the BJH-SDS and recorded the screen results in the patient's chart. This study was not meant to test nursing ability to perform the screen as this was demonstrated in the previous study, in which 50 nurses demonstrated inter-rater reliability and test–retest reliability (measured by Cohen κ) to be 94% and 92%, respectively. The screen result was recorded as "fail" if any 1 of the 5 items tested were abnormal (Glasgow Coma Scale $<$ 13, facial/tongue/palatal asymmetry or weakness, or signs of aspiration on the 3 ounce water test) or "pass" if all 5 items tested were normal. After the BJH-SDS was completed, the VFSS was performed within 8 hours to avoid significant change in the neurological examination (mean 2 hours; range 0-8 hours).

Detection of Dysphagia and Aspiration on the VFSS

For the VFSS, subjects were assigned a licensed SLP who was blinded to the results of the BJH-SDS. The Dysphagia Outcomes Severity Scale (DOSS) was used as the functional scale for identifying dysphagia on the VFSS.[9] This 7-point scale, chosen for its high reliability, was scored based on diet recommendations, level of assistance, and modifications required for safe oral intake. A score of 5 or less on the DOSS was the prespecified definition for dysphagia. The New Zealand Index of Multidisciplinary Evaluation of Swallowing (NZIMES) was used as the functional scale for identification of aspiration on the VFSS.[10] A score of 2 or more was the prespecified definition for aspiration. The NZIMES was chosen as it has a cutoff for clearly defining aspiration below the level of the true vocal cords. The SLP recorded each VFSS on a DVD that was reviewed with the radiologist (who was also blinded to the BJH-SDS results) until consensus was reached.

Statistical Analysis

The primary aim was to measure the sensitivity, specificity, and positive and negative predictive values of the BJH-SDS for detection of dysphagia and aspiration as identified by the gold standard, VFSS. A power analysis, based on a 35% prevalence of dysphagia, determined that 225 subjects would be needed to provide precise estimates of sensitivity and specificity, within 10% of the true values.

The secondary aim was to assess any major deleterious impact on pneumonia rates with the utilization of the BJH-SDS in the stroke unit. Before the development of the BJH-SDS, it was the responsibility of the SLP to screen patients for dysphagia following stroke. Between 2006 and 2008, there was a gradual transition of the screening responsibility to nursing staff with the SLP intervening for those patients who failed the BJH-SDS. By 2008, nursing had completely assumed responsibility for screening swallow function by using the BJH-SDS. A retrospective analysis was performed on all patients with a primary stroke diagnosis *International Classification of Diseases, Ninth Revision*, code (431, 432.9, 433, 434 with a fifth digit of 1, and 435) who were admitted between January 1, 2006, and December 31, 2010. The secondary *International Classification of Diseases, Ninth Revision*, diagnosis codes for pneumonia (480, 481, 482, 486, and 507) were collected