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Dysphagia in Old-Old Women: Prevalence as Determined by Self-Report and the 3 oz. Water Swallowing Test

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Abstract

Background/Objectives—Swallowing function changes through senescence placing elderly individuals at higher risk of developing dysphagia. Screening for swallowing dysfunction is not routinely performed in clinical practice. We sought to determine if clinical signs and symptoms of swallowing dysfunction could be easily identified in community-dwelling elderly and to examine the association between self-report and direct observation of signs and symptoms of swallowing dysfunction.

Design—Physiological sub-study conducted as a home visit within an observational cohort study.

Setting—Baltimore City and County, Maryland.

Participants—Forty-seven community-dwelling elderly women without history of dysphagia or neurologic disease aged 85 to 94 enrolled in the Women's Health and Aging Study II.

Measurements—Three trials of the 3 oz. water swallowing test, swallowing function questionnaire, and frailty status.

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Conflict of Interest:

The authors have no conflicts of interest to disclose.

Author Contributions:

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Results—Thirty-four (72%) and 16 (34%) subjects demonstrated swallowing dysfunction in at least one swallowing trial and all three trials respectively. The most common signs of dysfunction were throat clear and wet voice. Conversely, participants reported few symptoms of dysphagia on a swallowing function questionnaire. The most common symptom, reported by approximately 15% of participants, was the sensation of the food going “down the wrong way”. Other symptoms were reported by 8.5% or fewer participants.

Conclusion—Signs of swallowing dysfunction were present in a large majority of community-dwelling old-old women, but they were largely unrecognized and reported. Formal evaluation of swallowing function in community-dwelling elderly is necessary to determine the clinical consequences of these findings.

Keywords

swallowing; dysphagia; self-report; screening; water test

INTRODUCTION

By the year 2020, more than 20% of America’s population is expected to be over age 60. (1) Changes in swallowing have been described in the healthy elderly. (2) These changes can be a risk factor for developing dysphagia. It is well known that dysphagia threatens physical health because of dehydration, malnutrition, and aspiration (ingested material enters the trachea). (3–6) Quality of life can also be negatively impacted, especially since many of our social interactions occur during mealtimes. Dysphagia has been associated with social anxiety, withdrawal, and even depression. (7, 8)

Community-dwelling older adults report swallowing difficulties approximately 11–15% of the time. (9, 10,11) It is unclear if these reports are consistent with the true prevalence of dysphagia in the population, as diagnostic methods were not used to confirm dysphagia. Recent reports suggest approximately 30% incidence of aspiration in healthy older adults (>65 years of age). (12) Further prevalence as high as 53% has been reported using swallowing tests in elderly patients admitted to a sub-acute care unit. (13) Given the adverse consequences of dysphagia, it is particularly concerning that many older adults may not be aware of deficits or fail to report changes in swallowing.

It is possible that dysphagia is underreported by community-dwelling adults due to unawareness or lack of symptom recognition. It would be desirable to understand rates of under-recognition in order to evaluate the utility of screening and assessment. To our knowledge, there is currently no validated swallow evaluation protocol that targets community-dwelling older adults. Most of the research in this area is based on self-reported swallowing questionnaires, which have variable or unknown reliability. (9, 10, 14) Given that symptoms of dysphagia may remain unrecognized, it is necessary to determine the best way to perform standardized and valid dysphagia screenings in the elderly population and to understand rates of under-reporting.

This study had three goals. The first goal was to determine the prevalence of signs of dysphagia in a cohort of community-dwelling older women, ages 85 to 94, using a

standardized water swallowing task. Second, we compared these results to reports using a dysphagia questionnaire to assess under-reporting. Finally, we determined whether swallowing dysfunction was associated with frailty, a syndrome associated with dysfunction in multiple physiologic systems. We hypothesized that the proportion of women with a positive screening using the 3 oz water swallowing test would be higher than reported by previous research using self-report only (15%) and higher than reported by those same women using a swallowing function questionnaire. From a frailty standpoint, we hypothesized that there would be a positive association between swallowing dysfunction and frailty status. These findings will help evaluate whether unrecognized swallowing dysfunction is significant in the elderly and highlight the importance of further research on formal dysphagia screening in this population.

METHODS

Participants

Women enrolled in the Women's Health and Aging Study II (WHAS II), a prospective, population-based cohort study of community-dwelling elderly women, who were alive in 2009 were invited to participate. (15) The original cohort was composed of randomly sampled women 65 years recruited from the Health Care Financing Administration's Medicare Eligibility list for Baltimore, Maryland. Women aged 70–79 with difficulty in one or none of four domains of physical function (mobility tasks, upper extremity tasks, household management tasks, or self-care tasks) were eligible for inclusion in the original cohort. The resulting cohort was composed of the 436 of the two-thirds least disabled older women living in the community. Study visits occurred from 1994–2008 and included multiple evaluations. At the seventh study visit, subjects were invited to participate in home sub-studies. The swallowing testing was performed as part of the last sub-study in 2009–2010. All participants were alert and fully cooperative. The study and sub-studies were approved by The Johns Hopkins University Institutional Review Board. All the women provided informed consent to participate.

Variables of interest

Our main goal for this sub-study was to determine if there were signs suggestive of swallowing dysfunction in this population using a water swallowing test for screening. A questionnaire was administered first to determine if symptoms of swallowing dysfunction were reported by participants. We were also interested in whether personal or medical history factors had an impact on swallowing function. Demographic data (age, race), measured weight and BMI, number of physician diagnoses (self-reported), and specific diseases (stroke, coronary heart disease, COPD, cancer), and frailty status (16) were available from the last cohort's formal data collection cycle and were assessed in relation to swallowing status by the 3 oz water swallow test.

Swallowing questionnaire

A swallowing function questionnaire developed by our group was administered to determine if the participants reported experiencing symptoms and signs of dysphagia. The 13-item questionnaire was designed to determine the self-reported presence of common signs of

dysphagia or aspiration such as globus sensation, coughing, choking, specific food avoidance or voice changes while eating. It also included questions about dysphagia diagnosis, treatment, and history of diet modifications that would preclude participation in the water swallowing part of the study.

Swallowing protocol

The study protocol used was described originally by DePippo et al. (17) This water swallowing test was validated in a stroke population and can be easily administered in the home because it involves drinking from a cup in a natural way. Since this test does not image laryngeal or pharyngeal function or bolus flow, this test is best suited as a dysphagia screening test. The sensitivity and specificity of the test was originally reported as 76 and 59% respectively. Later work by Suiter and Leader (2007) reported sensitivity and specificity of 96.4 and 46.4% respectively in a mixed-disease population. (18) Participants were excluded if they had a history or diagnosis of swallowing dysfunction. While seated in a chair, participants were instructed to drink 3 oz. of water from a cup as they normally would, without stopping. Three drinking trials (total of 9 oz) were performed, unless the participant refused to continue. Participants were asked to voice “ah” immediately after each swallow trial to assess voice quality. At least a minute was allowed between each trial. A trained research assistant observed participants during each drinking trial and for a minute after each trial was completed. Specific observations recorded included: 1) stopping before drinking the whole amount, 2) choking, 3) coughing, 4) throat clearing, or 5) “wet” voice. Presence of these signs suggests the possibility of aspiration (in the case of wet voice also pharyngeal retention), and we defined a “failed” swallowing trial as any trial during which a participant demonstrated any of these signs. For example, a “wet” voice may be related to water entering the airway during swallowing thus changing vocal quality. Water swallowing trials were also video recorded to assess the reliability of the ratings. One of the investigators (MGF), blinded to the research assistant’s rating, independently rated 30 swallowing trials. Kappa statistics were used to assess agreement. Good agreement was confirmed statistically ($\kappa=0.73$). Given reliability, the results presented here rely on the original field assessment.

Frailty

Frailty status was originally defined by Fried et al. in the Cardiovascular Health Study (CHS) and later validated in the WHAS studies by Bandeen-Roche et al. (16, 19) The frailty construct includes five criteria: shrinking (body mass index [BMI] $<18.5 \text{ kg/m}^2$ or 5% annual weight loss), weakness (grip strength equivalent to the lowest quintile in CHS, by gender and BMI strata), poor endurance (self-reported exhaustion), slowness (walking speed equivalent to the lowest quintile in CHS, by gender and height strata), and low activity (activity level in kcal/week equivalent to the lowest quintile in CHS, by gender). The following scores classified women among three frailty categories based on the aforementioned validated criteria, including: frail (3+); pre-frail (1–2); and non-frail (0).

Data analysis

The proportions of participants reporting dysphagia or symptoms were assessed. Results of positive answers in the questionnaire were combined to generate a “questionnaire-positive”

variable to compare to the results of the water swallowing trials. Among those eligible for the swallowing test, participants were classified as failing the swallowing evaluation if they showed any sign of dysfunction during any one of the 3 oz water trials. For sample description, we determined the proportion of participants that failed 0, 1, 2, or 3 of the swallowing trials, the signs of failure, and failure sign frequency. Each participant could have demonstrated any of the 5 signs over three trials for a total of 15 possible occurrences. T-tests, 2-sample tests of proportions, and Fisher exact tests were used as applicable to determine statistical significance. All analyses were performed using Intercooled Stata version 11 (College Station, TX).

RESULTS

We identified 52 women for potential inclusion in the study of which 3 did not have a formal assessment in the last round of the study and whose recent demographic and medical history were not available. One woman answered the swallowing questionnaire but did not complete any water swallowing trials (by choice) and one woman reported a preexisting diagnosis of dysphagia. One woman reported history of esophageal surgery. This participant was included in the analysis as the problem was remote, and at the time of assessment no diet modifications were present precluding testing by drinking water. Thus, 47 women (mean age 86.3 years, range 85–94 years) were available for data analysis.

The results of the swallowing questionnaire are detailed in Table 1. In general, participants reported few symptoms of dysphagia. The most common symptom, reported by approximately 15% of participants (7/47), was the sensation of the food going “down the wrong way”. Other symptoms were reported by 8.5% or fewer participants. One participant reported history of swallowing problems but these had resolved at the time of the assessment after esophageal problems were surgically treated. One subject reported history of diet modifications to avoid acid foods due to gastric reflux, but these recommendations did not include changes in the consistency of food or thickness of liquids. A total of 21 women (44.7%) had a positive answer to at least one question on the questionnaire.

Results of the water swallowing screening are detailed in Table 2. Of the 47 women, 34 (72%) failed at least one swallowing trial. There were no statistically significant differences by age, education years, or race between the groups that passed or failed the swallowing screening test. Participants that did not demonstrate signs of swallowing dysfunction had a larger median number of clinical diagnoses compared to those that did. Of the four major comorbidities studied, only cancer had a significant negative association with fail status (Table 2). Reporting symptoms of swallowing dysfunction in the swallowing questionnaire was not associated with failing the water swallow test; 6/13 (46.2%) women that passed the water swallowing test had a positive answer on the questionnaire compared to 15/34 (44.1%) of those who failed the water swallowing test ($p=0.9$). Pre-frail participants had the highest proportion of screening failure (70.6%). This proportion was significantly different from the proportions in the other groups.

Of the 34 (72%) of cases that failed the swallowing screening test, 8 (17.0%) failed during one trial, 10 (21.3%) failed during 2 trials, and 16 (34.0%) failed all three trials. In the 34

participants that failed the test, the 3 most commonly observed signs were coughing (13; 38.2%), throat clearing (24; 70.5%), and wet voice (22; 64.7%). Figure 1 illustrates the proportion of each failure sign in the group. Interestingly, cough, throat clear, and wet voice were among the least frequently reported symptoms before screening (Table 1). The most infrequent signs of dysfunction were choking and inability to drink the full amount without stopping. Only 1 subject choked during 1 trial and 3 subjects stopped during one trial before drinking the full amount.

DISCUSSION

In this cross-sectional sample of 47 community-dwelling old-old women, ages 85–94, 72% of the women failed a screening swallowing test, defined by at least one sign of swallowing dysfunction during at least one of three trials of the 3 oz water swallowing test. Using a more stringent definition (failure on all 3 trials), 34% of the women demonstrated signs of swallowing dysfunction. These results are particularly striking in the absence of any history of dysphagia or an association between self-described symptoms of swallowing dysfunction and performance in the water swallowing test.

Implications

Swallowing is a vital function for survival. It is generally considered robust and preserved through the lifespan; however, this notion is being challenged as life expectancy increases. Estimates on incidence and prevalence of dysphagia in community-dwelling elderly have been sparse. One study using a dysphagia screening questionnaire administered to the entire population of people who were 65 years or older and living at home in a single town in Japan (2053 participants) reported a prevalence of dysphagia of 13.8%. (14) A more recent study on aspiration pneumonia in Japan suggests that aspiration pneumonia (as a proportion of all in hospital pneumonia cases) is rare before age 50 but the incidence progressively increases thereafter to approximately 50% by age 60 and 90% by age 90. (20) A study aiming to describe the prevalence of dysphagia in older patients being discharged from a sub-acute unit in Spain reported prevalence during hospitalization of 53.5% in a sample of 86 patients (mean age 83.8). (13) This literature supports our findings suggesting that: 1) estimates of dysphagia prevalence using questionnaires are unreliable, perhaps due to lack of symptom awareness or specificity and 2) the prevalence of signs of swallowing dysfunction is high in older women (85–94 years).

An important finding was the association of dysphagia with pre-frail status. We believe that the lack of a significant association between being frail and swallowing dysfunction is a result of low sample size. Perhaps frail individuals with swallowing dysfunction are less likely to survive thus being censored from our sample. This assumption has some support in the literature where dysphagia has been associated with increased mortality (nursing home population). (21,22) The same rationale can be used in the interpretation of the associations found by number of diagnoses and cancer. Women with higher numbers of concomitant diagnoses and with history of cancer surviving to older age are less likely to exhibit signs of dysphagia compared those who did not survive. Albeit preliminary, these findings support

the hypothesis that aging is a risk factor for sensorimotor dysfunction thus predisposing older adults to adverse outcomes such as dysphagia.

It is important to point out that the conclusions that we can make from this work are limited by the cross sectional nature of the data, the small sample size, and only including women. As mentioned above, the role of survival bias in this study cannot be ignored since cases that survived and remained in the cohort are healthier than those that did not survive. Nevertheless, the increased prevalence of signs of swallowing dysfunction in this group and its association with pre-frailty are important and further research is necessary to clarify the associations identified in this work.

Our screening procedures also limit the possible conclusions. The 3 oz. water swallow test is widely used but is validated for use in stroke patients and has not been validated for dysphagia screening in the elderly. It also has fairly low specificity, thus the number of false positive screens in this group is relatively high. Future studies are needed to examine how swallowing kinematics (using video fluoroscopy) correlate with the outcomes from a 3 oz water screening in a similar population as well as in older men. A formal cognitive evaluation was not done. This should be considered for future studies as it may affect symptom self-report.

CONCLUSION

High prevalence of dysphagia was identified in this cohort of community-dwelling women ages 85–94 with 72% of participants demonstrating at least one sign of swallowing dysfunction when screened using the 3 oz water swallow test. Participants demonstrating signs of swallowing dysfunction were more likely to be pre-frail. These findings suggest further research is necessary to characterize swallowing deficits from a physiologic standpoint and to characterize the performance of the water swallow test in this population.

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* Each person could have demonstrated one or more signs of swallowing dysfunction

Figure 1.

Proportion of Women Presenting Specific Signs of Swallowing Dysfunction During the 3 oz Water Swallowing screen *, n=47

* Each person could have demonstrated one or more signs of swallowing dysfunction

Table 1

Proportion of Participants Reporting Dysphagia Signs or Symptoms on the administered questionnaire, n=47.

Question	N (%)
Food/Liquid “go down wrong way?”	7 (14.9)
Food avoidance	3 (6.4)
Does food get stuck in throat or chest?	3 (6.4)
History of Swallowing problems	1 (2.1)
History of diet modifications	1 (2.1)
Symptoms	
<i>Cough</i>	4 (8.5)
<i>Choke</i>	4 (8.5)
<i>Spit</i>	0 (0)
<i>Food/liquid into nose</i>	1 (2.1)
<i>Throat clearing</i>	1 (2.1)
<i>Voice Changes</i>	0 (0)
<i>Multiple symptoms reported</i>	3 (6.4)

Table 2

Demographic and Sample characteristics by Swallowing screening results, WHAS sub-study, N=47

Characteristic	Pass Swallow Screen n = 13	Fail Swallow Screen n= 34	P value
Age in y, mean ($\pm$ SD)	89 (2.9)	88 (1.7)	0.37
Race, n (%)			0.69
Caucasian	10 (76.9)	28 (82.3)	
African- American	3 (23.1)	6 (17.6)	
Weight in lbs, median (range)	136 (106–205)	140 (88–204)	0.75
BMI in kg/m ² , median (range)	25.1 (20.3–36.4)	26.9 (17.7– 37.3)	0.90
Years of education, median (range)	13 (9–18)	12 (6–18)	0.67
Number of Diagnoses, median (range)	2(1–4)	1(0–3)	0.01
Questionnaire positive *	6 (46.2)	15 (44.1)	0.90
Physician-reported diagnoses			
Stroke, n (%)	2 (15.4)	5 (14.7)	1.00
Coronary Heart Disease, n (%)	1 (7.7)	10 (29.4)	0.15
COPD, n (%)	4 (30.8)	14 (41.2)	0.74
Cancer, n (%)	6 (46.2)	3 (8.8)	0.01
Frailt , n (%)			0.02
Frail	4 (30.8)	2 (5.9)	
Pre-Frail	4 (30.8)	24 (70.6)	
Not Frail	5 (38.5)	8 (23.5)	

* Any positive response to a question on the swallowing questionnaire