

Videofluoroscopic Evaluation of Aspiration with Visual Examination of the Gag Reflex and Velar Movement

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Abstract. The purpose of the present study was to investigate the relationship between prevalence of aspiration as determined by videofluoroscopic evaluation and prevalence of the gag reflex and velar movement as determined by direct visual examination. One hundred adult patients underwent a videofluoroscopic evaluation of aspiration with either an esophagram ($n = 31$), upper gastrointestinal series ($n = 18$), small bowel series ($n = 23$), or modified barium swallow procedure ($n = 28$), and concomitant evaluation of the gag reflex and velar movement on phonation. All studies were performed using the lateral, upright position, and all patients drank at least 5 cc of single contrast barium. Aspiration was defined as penetration of material below the level of the true vocal folds. A normal gag reflex and normal velar movement on phonation were observed in 14 of 15 (93%) patients who exhibited objective documentation of aspiration with videofluoroscopy. Conversely, 19 of 20 (95%) patients without a gag reflex were observed with videofluoroscopy to be without aspiration. Normal velar movement on phonation was observed in 99 of 100 (99%) patients. There was no significant age difference between patients with or without a gag reflex. No relationship was found between the prevalence of aspiration and the gag reflex or velar movement on phonation. It was concluded that the presence of a gag reflex does not protect against aspiration, and the absence of a gag reflex does not predict aspiration.

Key words: Aspiration — Gag reflex — Fluoroscopy — Deglutition — Deglutition disorders.

A previous report [1] investigated the relationship between the gag reflex and swallowing ability based upon a clinical bedside dysphagia evaluation [2]. It was found that although all subjects were referred for an evaluation specifically because they had no gag reflex and were considered, a priori, an increased aspiration risk, 86% were nevertheless able to eat at least a puree diet. In addition, 86% of subjects with no gag reflex had normal velar movement, reinforcing the physiologic difference between velar functioning during phonation and the gag reflex. The diagnosis of dysphagia was not based upon status of the gag reflex, and it was concluded that absence of the gag reflex was not a predictor of dysphagia [1].

A bedside dysphagia evaluation, however, cannot directly assess pharyngeal phase or esophageal phase dysphagia or aspiration [3–5]. Only an objective test, e.g., a videofluoroscopic evaluation using the modified barium swallow procedure [6,7], would have been able to confirm the presence or absence of aspiration in those patients who exhibited an absent gag reflex [1].

Despite the fact that the gag reflex is a protective response that does not normally occur during the act of swallowing [8,9], and no causative data have been reported to support a relationship between swallowing ability and the gag reflex [1], the erroneous clinical opinion that an absent gag reflex increases aspiration risk [2] and that a criterion for initiation of oral intake is the presence of a gag reflex [10] are often held by health care professionals. The purpose of the present study was to investigate objectively the relationship, if any, between prevalence of aspiration as determined by videofluoroscopic evaluation and prevalence of the gag reflex and velar movement as determined by direct visual examination.

Materials and Methods

During a 7-week period, 100 patients underwent videofluoroscopy. All studies were performed using the lateral, upright position. One group

had videofluoroscopy with either an esophagram ($n = 31$), upper gastrointestinal series ($n = 18$), or small bowel series ($n = 23$) (total $n = 72$). There were 29 men and 43 women, with an age range from 17 years 8 months to 85 years 9 months (mean age 49 years 5 months). The other group had a videofluoroscopic evaluation using the modified barium swallow procedure ($n = 28$). There were 13 men and 15 women, with an age range from 31 years 8 months to 85 years 3 months (mean age 66 years 1 month). All patients gave informed consent following a full explanation of the procedure.

During the course of an oral mechanism examination, the gag reflex was tested by touching the posterior tongue or posterior pharyngeal wall with a tongue blade, and assessed visually. The gag reflex is triggered by sensory innervation from the glossopharyngeal nerve [11,12] either in response to noxious stimuli, e.g., vomit, reflex, or strongly disliked foods, or when a foreign body, e.g., a tongue blade, touches the posterior tongue or posterior pharyngeal wall [2,13]. The gag reflex is characterized by elevation of the larynx and pharynx and a sudden contraction of the soft palate and pharyngeal constrictors with the purpose of expelling the noxious stimuli orally [9]. Results were classified: without gag (no response); normal gag (mild velar/pharyngeal contraction, mild pulling away); or hyper-gag (retching, forceful velar/pharyngeal contraction, severe pulling away).

Velar movement on phonation was tested by having the patients open his mouth and say "ah," and assessed visually. A normal response is characterized by symmetrical elevation of the soft palate with the uvula remaining in the midline [12]. Results were classified as without movement, normal movement, or asymmetrical movement.

Patients referred for an esophagram, upper gastrointestinal series, or small bowel series were observed videofluoroscopically swallowing 5 cc of single contrast barium only, and any aspiration noted. A videofluoroscopic evaluation of swallowing was performed on the patients referred for a modified barium swallow. These patients were given bolus consistencies of 5 cc each of single and double contrast barium, puree plus barium, and, if tolerated, solid plus barium, and any aspiration noted. Aspiration was defined as when material penetrated the larynx and entered the airway below the level of the true vocal folds [2].

The gag reflex and velar movement were tested, assessed visually, and classified by the author. Aspiration during an esophagram, upper gastrointestinal series, small bowel series, or modified barium swallow was determined with 100% agreement between the author and radiologist.

Selection criteria included no surgery to the soft palate, (e.g., uvulopalatopharyngoplasty or pharyngeal flap), no surgery to areas that trigger the gag reflex, no medications that could cause dysphagia or suppress the gag reflex and velar movement, and adequate cognitive functioning to perform the evaluation procedure.

Results

Table 1 shows the prevalence of aspiration in patients ($n = 72$) who underwent an esophagram, upper gastrointestinal series, or small bowel series subdivided by results of the clinical examination of the gag reflex and velar movement on phonation.

Table 2 shows the prevalence of aspiration in patients ($n = 28$) who were referred for a videofluoroscopic evaluation with the modified barium swallow procedure subdivided by results of the clinical examination of the gag reflex and velar movement on phonation.

Examination of Tables 1 and 2 reveals that the gag reflex was absent in 13 of 72 (18%) patients referred

Table 1. Prevalence of aspiration in 72 patients as determined by videofluoroscopic examination with an esophagram, upper gastrointestinal series, or small bowel series subdivided by results of clinical examination of the gag and velar movement on phonation

Gag reflex			Velar movement		
No	Normal	Hyper	No	Normal	Asymmetric
0/13 (0%)	3/51 (6%)	0/8 (0%)	0/0 (0%)	0/71 (0%)	1/1 (100%)

Table 2. Prevalence of aspiration in 28 patients as determined by videofluoroscopic examination with a modified barium swallow procedure subdivided by results of clinical examination of the gag reflex and velar movement on phonation

Gag reflex			Velar movement		
No	Normal	Hyper	No	Normal	Asymmetric
1/7 (14%)	11/21 (52%)	0/0 (0%)	0/0 (0%)	12/28 (43%)	0/0 (0%)

for an esophagram, upper gastrointestinal series, or small bowel series, and 7 of 28 (25%) patients referred for a videofluoroscopic evaluation using the modified barium swallow procedure, for a total of 20 of 100 (20%) patients. A normal gag reflex and normal velar movement on phonation were observed in 14 of 15 (93%) patients with objective videofluoroscopic documentation of aspiration. Conversely, 19 of 20 (95%) patients without a gag reflex were observed with videofluoroscopy to be without aspiration. In addition, 15 of 20 (75%) patients who did not have a gag reflex were less than 70 years of age and only 5 of 20 (25%) were greater than 70 years of age.

All Student's *t*-ratios for differences between mean ages were nonsignificant ($p > 0.05$) grouped for videofluoroscopic study, i.e., an esophagram, upper gastrointestinal series, or small bowel series vs. the modified barium swallow procedure, and based upon status of the gag reflex.

Discussion

The prevalence of aspiration and the gag reflex in the present study is in agreement with a preliminary report which stated that the presence of a gag reflex does not protect against aspiration [10], and corroborates previously reported clinical findings that absence of a gag reflex does not appear to be a predictor of dysphagia [1] or have functional consequences [14].

The present objective data, therefore, confirm and support the previously reported clinical data [1,14] that no relationship exists between prevalence of aspira-

tion and the gag reflex. An impaired or absent gag reflex, however, may be indicative of a more generalized motor or sensory involvement, with resultant deficiency in the oral preparatory, oral, and pharyngeal phases of swallowing [5]. Therefore, dysphagia may be present but not due to absence of the gag reflex *per se*.

The cough, not the gag, reflex appears to be the protective reflex during swallowing [15,16]. The cough reflex is elicited when material enters either the larynx and touches or penetrates the true or false vocal folds or the trachea [2]. The material is then either swallowed again or expectorated.

There is a paucity of normative data on the gag reflex. Beltrani [17] reported the gag reflex to be absent in 31 of 100 (31%) normal adults and Davies et al. [14] reported the gag reflex to be absent in 51 of 138 (37%) healthy subjects (68 elderly and 70 young adults). The gag reflex was previously found to be absent in 9 of 69 (13%) normal, nondysphagic adults [1]. The above studies reveal that the gag reflex was absent from 13% to 37% in normal, healthy, nondysphagic adults, making the gag reflex's clinical relevancy and predictive value highly questionable.

The gag reflex was reported to be absent more frequently in the elderly [14]. This was not corroborated in the present study. The gag reflex may not be influenced by or as sensitive to aging as reported loss of oral sensation [18]. No large population samples or longitudinal data investigating the gag reflex, however, have been reported.

The physiologic difference between velar functioning during phonation and the gag reflex [8,19,20] was reinforced since only 1 of 100 (1%) patients in the present study exhibited abnormal velar movement on phonation, despite the fact that 28 of 100 (28%) patients exhibited either no gag reflex or a hyper-gag reflex. Impaired velar functioning, especially paralysis resulting in velopharyngeal valving problems, may result in nasal reflex and oropharyngeal dysphagia. It would be of interest to investigate dysphagia and prevalence of aspiration videofluoroscopically in this population.

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