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Fiberoptic Endoscopic Evaluation of Dysphagia to Identify Silent Aspiration

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Abstract. The traditional bedside dysphagia evaluation has not been able to identify silent aspiration because the pharyngeal phase of swallowing could not be objectively assessed. To date, only videofluoroscopy has been used to detect silent aspiration. This investigation assessed the aspiration status of 400 consecutive, at risk subjects by fiberoptic endoscopic evaluation of swallowing (FEES). Our study demonstrated that 175 of 400 (44%) subjects were without aspiration, 115 of 400 (29%) exhibited aspiration with a cough reflex, and 110 of 400 (28%) aspirated silently. No significant differences were observed for age or gender and aspiration status. The FEES, done at bedside, avoids irradiation exposure, is repeatable as often as necessary, uses regular food, can be videotaped for review, and is a patient-friendly method of identifying silent aspiration.

Key words: Aspiration — Silent aspiration — Fiberoptic endoscope — Dysphagia — Modified barium swallow — Videofluoroscopy — Deglutition — Deglutition disorders.

The literature clearly indicates that clinical, bedside evaluation is an inadequate and poor predictor of pharyngeal phase dysphagia [1–3]. Although a number of studies have attempted to identify a consistent and reliable set of clinical indicators for diagnosing pharyngeal phase dysphagia at bedside examinations [1–6], no consensus has been reached as to the identification or hierarchical ordering of indicators.

A major deficiency of clinical examination of the pharyngeal phase of swallowing is silent aspiration [1–6], defined as entry of the bolus below the level of the true vocal folds without any external behavioral signs such as coughing or choking. Silent aspiration has been reported to occur in over 40% of patients referred for dysphagia evaluations in a rehabilitation hospital [2] and in as much as 77% of ventilator-dependent patients [7]. The bedside evaluation has not been able to identify silent aspiration because the pharyngeal phase of swallowing could not be objectively assessed. Silent aspiration, therefore, can only be identified and confirmed by visualization [1].

Two examinations capable of providing visualization of the dysfunctioning pharynx and larynx are videofluoroscopy, i.e., modified barium swallow (MBS) [8,9], and endoscopy, i.e., fiberoptic endoscopic evaluation of swallowing (FEES) [10,11]. To date, the examination used for identifying silent aspiration in acute care, rehabilitation, and outpatient settings has been the MBS [1–6]. The purpose of this study was to investigate the use of the FEES for identifying silent aspiration.

Methods

Subjects

A total of 400 consecutive subjects admitted to a large, urban, tertiary care, teaching hospital and referred for a dysphagia evaluation participated. All FEES evaluations were performed within 48 h of receiving the consultation request. There were 229 males (57%) and 171 females (43%), with an age range of 10 years 2 months to 101 years 1 month. Many different diagnoses reflective of the general hospital population and spanning the neurological, surgical, and medical specialties were included. Table 1 shows the most common diagnoses and FEES results, demonstrating either absence of aspiration, aspiration with a cough reflex, or silent aspiration.

Procedures

In our first subgroup, subjects 1–56 were evaluated with both an MBS and FEES. In our second subgroup, subjects 57–400 were evaluated

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Table 1. Most common diagnoses* and FEES results

Diagnosis	n	Absence of aspiration	Aspiration with a cough reflex	Silent aspiration
Other[a]	115	54	32	29
Pulmonary[b]	45	15	13	17
Trauma[c]	45	28	6	11
Right cerebrovascular accident	42	25	8	9
Left cerebrovascular accident	39	18	13	8
Dementia[d]	21	8	11	2
Intracranial hemorrhage[e]	21	5	8	8
Degenerative neurologic disease[f]	20	9	5	6
Cardiac[g]	18	5	4	9
Oral/pharyngeal cancer	15	2	7	6
Vocal fold paralysis	13	3	5	5
Brainstem cerebrovascular accident	6	3	3	0
Total	400	175	115	110

*Five or more subjects.
[a]All diagnoses with four or less subjects.
[b]Chronic obstructive pulmonary disease, lung cancer, asthma, anoxia, respiratory failure, acute respiratory distress syndrome, and pneumonia.
[c]Motor vehicle accidents, falls, and gunshot wounds.
[d]Alzheimer's disease and senile dementia.
[e]Subarachnoid hemorrhage and cerebral aneurysms.
[f]Parkinson's disease, multiple sclerosis, muscular dystrophy, myasthenia gravis, and amyotrophic lateral sclerosis.
[g]Coronary artery bypass graft(s) and valve replacement(s).

solely with a FEES. MBS subjects were evaluated in the fluoroscopy suite and FEES subjects were evaluated in the intensive care units, step-down units, and inpatient hospital rooms. The basic protocols for the MBS [8,9] and FEES [10,11] examinations were followed. No administration of a topical anesthetic or vasoconstrictor to the nasal mucosa prior to a FEES was done, thereby eliminating any potential adverse anesthetic reaction and assuring the endoscopist of a safe physiologic examination [12]. In the present study, a puree bolus was always given first, followed by a liquid bolus and then a solid bolus, if indicated.

The MBS and FEES dysphagia evaluations from subjects 1–56 were videotaped and reviewed independently by an otolaryngologist (CTS) and radiologist (MIB) to identify silent aspiration. The reviewers were blinded to each others' results. There was 100% agreement regarding the identification of silent aspiration. These evaluations provided a baseline for identifying silent aspiration. The FEES evaluations from subjects 57–400 were not videotaped and silent aspiration was identified at the time of testing.

Results

Table 2 shows the results of the FEES evaluations for all subjects (n = 400) grouped by gender and results of the FEES, i.e., absence of aspiration, aspiration with a cough reflex, or with silent aspiration. It can be seen that 175 of 400 (44%) subjects were without evidence of aspiration, 115 of 400 (29%) had aspiration with a cough reflex, and 110 of 400 (28%) were silent aspirators.

Table 2. Results of FEES evaluations for all subjects ($n = 400$)

	Absence of aspiration	Aspiration with a cough reflex	Silent aspiration
Male	97 (42%)	66 (29%)	66 (29%)
Mean age (yrs:mos)	60:3	72:0	66:6
Standard deviation	19.87	14.36	15.15
Female	78 (46%)	49 (29%)	44 (26%)
Mean age (yrs:mos)	64:5	65:7	68:8
Standard deviation	19.12	16.38	16.67
Total	175 (44%)	115 (29%)	110 (28%)

In the first subgroup, silent aspiration was identified in 21 of 56 (38%) subjects—13 of 30 (43%) male, and 8 of 26 (31%) female—who had both an MBS and FEES. Agreement between the MBS and FEES examinations was reached on 54 of 56 (96%) subjects, i.e., one subject silently aspirated during the MBS but coughed during the FEES and another subject did not aspirate during the MBS but silently aspirated during the FEES.

In the second subgroup, the FEES alone identified silent aspiration in 89 of the remaining 344 (26%) subjects, 53 of 200 (27%) male and 36 of 144 (25%) female. The total number of subjects who were identified with silent aspiration was 110 of 400 (28%), 66 of 229 (29%), male and 44 of 171 female (26%).

An analysis of variance and Tukey Multiple Comparison test did not reveal any significant differences between gender and FEES results ($p > 0.05$) or age and FEES results ($p > 0.05$), i.e., absence of aspiration, aspiration with a cough reflex, or with silent aspiration.

Discussion

The present study reported the largest sample size to date of silent aspiration diagnosed by a FEES. One hundred ten of 400 (28%) subjects referred for a dysphagia evaluation and representing a wide variety of diagnoses (Table 1) were identified as exhibiting silent aspiration. In addition, our combined MBS and FEES results were comparable to those in the only other study that reported MBS and FEES comparisons for silent aspiration [11].

The FEES allows for visualization of the pharynx and larynx immediately before and after the swallow, when silent aspiration of pooled secretions can most easily be seen. Silent aspiration due to spillage of the bolus into the laryngeal vestibule, glottis, and trachea, which may occur before the swallow, can be observed. Silent aspiration, both immediately following the swal-

low and due to retention of the bolus in the vallecula, pyriform sinuses, and laryngeal vestibule after the swallow, is also clearly identified via the endoscopic image.

The large and heterogeneous sample in the present study provided a more adequate population pool from which to identify prevalence of silent aspiration. The reported overall 28% rate of silent aspiration may be more accurate than the higher (or lower) percentages reported in previous studies with either smaller sample sizes or more homogeneous populations [1–6].

Individual subject's swallowing variability, from both trial to trial and with repeated examinations [14], supports the discrepancies observed for the 2 subjects in the present study. Different swallowing outcomes may be attributed to individual variability, elapsed time between the two examinations, and the differences between the MBS and FEES procedures.

Previous investigations, from a rehabilitation hospital [2] and ventilator support center [7], reported that silent aspirators were older than nonaspirators. However, with a larger and more heterogeneous sample size, no age differences were found among subjects who either did not aspirate, aspirated with a cough reflex, or silently aspirated.

Conclusion

The FEES, done at bedside, avoids irradiation exposure, is repeatable as often as needed, uses regular food, and can be videotaped for review [10,11,13,15,16]. In a large, heterogeneous population we conclude that the FEES is a reliable, transportable, repeatable, and patient-friendly method of identifying silent aspiration.

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