



Fiberoptic Endoscopic Evaluation of Swallowing in children: Feeding outcomes related to diagnostic groups and endoscopic findings

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ABSTRACT

Objective: Fiberoptic Endoscopic Evaluation of Swallowing (FEES) is used as an adjunct to assess swallowing function in children with complex feeding disorders. We report the feeding outcomes of patients who underwent FEES to determine whether associations exist between clinical diagnoses or FEES findings and feeding outcomes.

Methods: Retrospective review of children who underwent FEES for dysphagia or aspiration from 2003 to 2009. The clinical diagnoses and initial FEES findings were compared to follow up feeding status for associations.

Results: 79 patients were included (44 males and 35 females). The change from initial to final status: total oral feeding (42–67%), NPO $\pm$ minimal tastes (39–21%) and oral feeding with tube feeding (19–12%). Of the clinical diagnoses, tonsillar hypertrophy was associated with ultimately obtaining total oral feeding status ($p = 0.046$) while the inability to obtain total oral feeding status was associated with neurologic ($p < 0.001$). The initial FEES findings showed no significant associations with long-term feeding status.

Conclusion: Many children overcome their dysphagia but those with neurologic disorders are less likely to achieve total oral feeding status. In children with dysphagia evaluated by FEES, the long-term feeding status is not significantly associated with the initial FEES findings.

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1. Introduction

Dysphagia is seen frequently in children with multiple medical problems. In order for professionals to make optimal management recommendations, a thorough diagnostic workup is needed. Fiberoptic Endoscopic Evaluation of Swallowing (FEES) is an instrumental tool to evaluate aspects of swallowing in patients with dysphagia. FEES uses transnasal flexible fiberoptic laryngoscopy (FFL) to visualize the pharynx and larynx during swallowing. Langmore et al. provided the first description of FEES in adults by observing them swallow foods of different textures and consistencies during the FFL [1].

More recently, FEES has been shown to be a valuable and reliable method for the diagnosis and management of swallowing

disorders in children [2,3]. Hartnick et al. showed the utility of FEES in 568 pediatric patients to diagnose many laryngeal and swallowing disorders at the same time with one examination [2]. Leder and Karas reported on 30 pediatric inpatients. They assessed 7 subjects with videofluoroscopic swallow study (VFSS) and FEES, while 23 subjects were assessed with FEES only. They compared the results of FEES and VFSS in 7 subjects with VFSS always completed before FEES and found 100% agreement in penetration and aspiration. Feeding recommendations were also in 100% agreement based on testing with both instrumental examinations [3]. Both Hartnick et al. [2] and Leder and Karas [3] reported that following initial FEES, 40% of children were recommended to take nothing by mouth because of risk of aspiration. In contrast, da Silva et al. in 2010 showed overall low diagnostic agreement on early spill over, pharyngeal residue, laryngeal penetration, or laryngotracheal aspiration, from two observers between FEES and VFSS. The best interobserver agreement occurred for aspiration and penetration on FEES for which the highest specificity and positive predictive value occurred when compared to VFSS [4].

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Table 1

Demographics, post FEES and follow up feedings status separated by clinical diagnosis.

Clinical diagnosis [*]	Age at initial FEES (months)		Follow up (months)		Percent of total patients (n = 79)	Post FEES recommendations				Feeding status at follow up			
	Mean	SD	Mean	SD		NPO	Taste	Partial oral	Total oral	NPO	Taste	Partial oral	Total oral
Neurologic disorder	28.2	23.35	54.16	28.13	32% (n = 25)	10	6	6	3	3	7	7	8
Genetic disorder	31.43	27.59	48.61	27.19	35% (n = 28)	6	9	3	10	3	6	5	13
Vocal fold dysfunction	17.23	21.37	35.47	24.94	22% (n = 17)	2	3	5	7	0	3	0	15
Congenital heart defect	21.75	21.02	33.32	22.34	28% (n = 22)	2	7	8	5	0	5	1	16
Tonsillar hypertrophy	33.64	21.21	54	22.68	14% (n = 11)	0	0	2	9	0	0	0	11
Prematurity	26.4	24.71	28	20.32	19% (n = 15)	2	5	3	5	0	5	0	10
Micrognathia	10.67	3.79	52	28.62	4% (n = 3)	0	2	0	1	0	0	2	1

^{*} Many patients had multiple diagnoses.

In comparison to VFSS, FEES has the added benefits of evaluating laryngeal anatomy, carrying out the examination at the bedside, and avoiding radiation exposure to both patient and examiners. Five components are assessed during FEES: (1) anatomy of the pharynx and larynx, (2) functional movements of the larynx and hypopharynx, (3) management of secretions, (4) pharyngeal swallowing function, and (5) the effect of therapeutic maneuvers.

1.1. Purpose

The purpose of this retrospective report is to describe the feeding outcomes of patients who underwent FEES and to determine whether associations exist between clinical diagnoses and feeding outcomes as well as associations between FEES findings and feeding outcomes.

2. Methods

A retrospective record review was completed for pediatric patients who underwent FEES for dysphagia or concerns of aspiration from 2003 to 2009. Approval was obtained from the Children's Hospital of Wisconsin Institutional Review Board. Patients were excluded if follow-up was less than 6 months after the initial FEES unless they were total oral feeders at that time. The chart review yielded clinical diagnoses, FEES findings, pre-FEES feeding status, post-FEES feeding recommendations, and feeding outcomes.

2.1. FEES procedure

At our institution, FEES is carried out as a team approach to include a nurse, an otolaryngologist, and a speech-language pathologist (SLP). The nurse meets with the family and explains the procedure. The otolaryngologist completes a clinical head and neck evaluation. The SLP assesses oral anatomy and function prior to introduction of the endoscope. No topical anesthesia or decongestant is used. For young children, the caregiver or nurse stabilizes the head while the FFL is inserted by the otolaryngologist into the patient's nose to the level of the soft palate where the larynx and hypopharynx can be visualized. Structural and functional anatomy and status of secretions are observed prior to the presentation of food and/or liquid. Food and/or liquid are prepared with one drop of standard household green food coloring per 4–8 ounces to aid in visualization. The SLP presents liquid and food of different textures and consistencies appropriate for the patient. Post-FEES feeding recommendations are made by the SLP and otolaryngologist. Future changes in feeding status following FEES was decided by the SLP, otolaryngologist, nutritionist, or gastroenterologist by performing an additional FEES, VFSS, or clinical bedside swallow evaluation.

2.2. Chart review

The following abnormalities were noted: (1) delay in initiation of swallowing or premature entry of the bolus over the base of the tongue prior to initiation of swallow, (2) penetration of the bolus into the laryngeal vestibule, (3) aspiration of material below the true vocal folds, and (4) residue of the bolus in the hypopharynx after swallowing. Pre-FEES feeding status, Post-FEES recommended feeding status, and last documented feeding status were recorded and placed into one of four categories: (1) total oral intake, (2) partial oral intake with tube feeding supplementation, (3) tastes only with tube feeding providing >95% of nutrition and hydration needs, and (4) nothing by mouth (NPO).

2.3. Statistical analyses

Fisher's Exact Test was applied to the data and adjusted using logistic regression to compare clinical diagnoses and FEES findings to the final feeding status at final chart review.

3. Results

Between 2003 and 2009, 85 patients underwent FEES at the Children's Hospital of Wisconsin. Six patients were excluded due to inadequate follow up or inability to acquire data. Seventy-nine patients (44 males and 35 females) were included in the study. Average age at initial FEES was 26 months (SD = 27 months; range 12 days to 170 months). Average duration of follow up was 42 months (SD = 26 months; range 6–96 months). Only 7 patients had follow up less than 12 months. Of those 7 patients, 6 patients were total oral feeders at initial FEES and during their follow up while 1 patient was tube fed with tastes at both the initial FEES and at the 7-month follow up. Most patients (n = 68) had only one FEES. Nine patients had 2 FEES, 1 patient had 3, and 1 patient had 4 FEES.

Clinical diagnoses included congenital heart defects (CHD), neurologic disorders, prematurity (defined as gestation age less than 37 weeks), vocal fold dysfunction (VFD), micrognathia, tonsillar hypertrophy (greater than or equal to 3+), and clinically diagnosed genetic disorders. Clinical diagnoses of patients with age at time of initial FEES, time to follow up, post-FEES feeding recommendations, and follow up feeding status are shown in Table 1. Many patients had multiple diagnoses. Specific genetic disorders are shown in Table 2 and neurologic disorders shown in Table 3.

Pre-FEES dysphagia and feeding recommendations were based on VFSS in 84% (n = 66), upper gastrointestinal X-ray series or esophagram in 6% (n = 5), and bedside clinical swallowing evaluation by a speech pathologist in 10% (n = 8) patients. Pre-FEES feeding status was compared to post FEES feeding recommendations. Fifteen patients (19%) were recommended to change feeding status following FEES status. Twelve patients' feeding status was advanced and 3 patients' feeding status regressed. Table 4 demonstrates changes made for the 15 patients.

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