

Endoscopic evaluation of swallowing in children: 3 years of experience

Original Article

Authors

Joana Nascimento

Centro Hospitalar Universitário de Lisboa Central

Inês Moreira

Centro Hospitalar Universitário de Lisboa Central

Inês Cunha

Centro Hospitalar Universitário de Lisboa Central

Ana Forjaco

Centro Hospitalar Universitário de Lisboa Central

Pedro Alves

Centro Hospitalar Universitário de Lisboa Central

Joana Ximenes Araújo

Hospital José de Almeida - Cascais

José Pinto Sousa

Centro Hospitalar Universitário de Lisboa Central

Bernardo Araújo

Centro Hospitalar Universitário de Lisboa Central

Herédio Sousa

Centro Hospitalar Universitário de Lisboa Central

Ezequiel Barros

Centro Hospitalar Universitário de Lisboa Central

Correspondence:

Joana Nascimento
Serviço de Otorrinolaringologia, Hospital Dona Estefânia,
Centro Hospitalar Universitário Lisboa Central
R. Jacinta Marto, Lisboa, Portugal.
Email: joana-nascimento@campus.ul.pt
Telephone: 00351910557419

Article received on September 9, 2021.
Accepted for publication on November 15, 2021.

Abstract

Swallowing disorders in children affect approximately 1% of children per year in the United States and are often underdiagnosed. The development of noninvasive diagnostic techniques has allowed for more accurate diagnoses, regardless of age.

This study aims to identify the prevalence of swallowing disorders and the need for instrumental evaluation by videofluoroscopy of swallowing (VFD) and/or fiberoptic endoscopic evaluation of swallowing (FEES) in patients followed at the pediatric laryngeal consultation and to describe two representative cases, emphasizing the specificities of performing FEES in children.

A retrospective analysis of pediatric patients followed in the laryngeal consultation between 2018-2020 was performed.

Of the 278 children evaluated, swallowing disorders were found in 26% (n=71). FEES was performed in 24%, VFD in 32%, and 10% of children underwent both exams.

Those patients who underwent FEES, structural laryngeal pathology was the most commonly found alteration, while 3 patients had neurological conditions.

VFD and FEES are complementary tests, essential to diagnose anatomical defects, and are the only objective way to confirm or exclude aspiration. FEES in pediatrics has specific characteristics and requires experience to perform and interpret.

Keywords: children; dysphagia; swallowing disorders; endoscopic evaluation

Introduction

Swallowing is a complex process controlled by the central nervous system (CNS) that entails four stages, namely pre-oral, oral, pharyngeal, and esophageal, during which the food bolus is formed and propelled to the stomach through the oropharynx, hypopharynx, and esophagus.^{1,2}

Swallowing impairment in children is associated with the risk of nutritional deficiency, dehydration, developmental delay and, in cases of chronic laryngeal/tracheal aspiration,

the risk of pulmonary morbidity such as bronchospasm, aspiration pneumonia, or even lung abscess.^{1,2} The causes of these disorders vary and are often multifactorial.

The management of children with diseases associated with swallowing impairments may require information obtained via exams that assess specific anatomical and physiological aspects underlying the process of swallowing that are not visible during routine clinical evaluation.³ Objective evaluation may require complementary exams such as a videofluoroscopic swallowing study (VFSS) and a fiberoptic endoscopic evaluation of swallowing (FEES).^{3,4} VFSS is the method of choice for the diagnosis and evaluation of swallowing disorders because it provides important physiological data on the various stages of swallowing.⁵

The use of these exams is the only objective means of monitoring oral and pharyngeal dysphagia and confirming or excluding tracheal aspiration.^{5,6}

Collaboration among members of a multidisciplinary team is important for the evaluation and guidance of affected patients.⁶ Such a team ideally comprises otorhinolaryngologists, pediatric gastroenterologists, radiologists, and speech therapists.

The aim of the present study was to determine the prevalence of swallowing impairment among patients followed in pediatric larynx consultation and the need to use instrumental evaluation procedures in the diagnosis and monitoring of these patients. Additionally, the specificities of performing FEES in children are described, and some representative cases are presented.

Material and Methods

This study is a retrospective analysis of pediatric patients followed in larynx consultation at a tertiary hospital for a period of 3 years, from 2018 to 2020 (n = 278). Among a total of 278 patients, only patients with swallowing impairment were included in this analysis (n = 71), namely children with signs and symptoms

of dysphagia and/or swallowing problems such as difficulty initiating swallowing, refusing to eat, and choking or coughing during eating.

The following data were collected from patients submitted to FEES: sex, age at the time of evaluation, symptom that led to the evaluation, comorbidities, and complications associated with the procedure. FEES was performed by a pediatric otorhinolaryngologist and a speech therapist, and at least three swallows were assessed for each tested food consistency. The protocol for performing FEES in children established in our institution is based on the international literature. This non-invasive exam is performed using a flexible endoscope with the appropriate diameter (2.2–4.0 mm) and foods of different consistencies (liquid, semisolid, and solid) that the child normally eats, which may be dyed with two to three drops of methylene blue for better visualization. Local anesthesia was used in the wider nasal fossa, namely a solution of 1:1 oxymetazoline and lidocaine 2%, unless there were contraindications (< 1 year of age, allergy, neurological condition, poor control of secretions). The patient was placed in a neutral position, that is, sitting on the lap of their caregiver, who wrapped the child's arms. The nurse adjusted and stabilized the patient's head. Before inserting the endoscope, it is essential to assess the need for secretion aspiration and/or oxygen supplementation. Anatomic and functional endoscopic examination of the potentially involved swallowing organs was then performed. At the level of the choanae, palate mobility was assessed spontaneously or by asking the patient to pronounce phonemes and checking for palate occlusion during the swallowing of saliva, when possible. Evaluation below the soft palate and behind the uvula entailed checking for the presence of anatomical changes in the oropharynx/hypopharynx and larynx, as well as for salivary stasis in the valleculae/pyriform sinuses and involuntary movements of the structures. Vocal cord mobility was then assessed, often during crying or during the production of vowels, when the child allowed

it. Whenever possible, the patient's ability to clear any existing stasis content by swallowing was evaluated. Evaluation of the cough reflex and pharyngeal and laryngeal sensitivity was performed by touching the base of the tongue, the posterior wall of the pharynx, the laryngeal surface of the epiglottis, and the aryepiglottic and arytenoid folds with the endoscope. In endoscopic assessment of swallowing, food of the consistency that was the safest for the patient was used first, in small amounts, and the evaluation was repeated using the other aforementioned consistencies. When necessary, the exam was adapted to the patient by alternating liquid and solid foods to aid swallowing and by adjusting the position of the head (e.g., lower jaw distraction, lowering the chin), considering the patient's age and clinical condition. With the endoscope placed below the palate, oral control was assessed by instructing the patient to swallow when asked (patient collaboration depended on age/comorbidities); ineffective oral control results in posterior premature spillage. In the pharyngeal stage of swallowing, coordination at the initiation of the swallowing reflex (pharyngeal contraction, retroflexion of the epiglottis) and the white-out effect (a term that describes the reflex of light on the structures) were evaluated. During the latter, it is impossible to assess part of the pharyngeal stage because of soft palate closure and posteriorization of the base of the tongue. Subsequently, food residue, laryngeal penetration, and laryngo-tracheal aspiration were evaluated, as well as glottic abduction and the cough reflex during these episodes. Food residue is the retention of secretions or food bolus residues in the hypopharynx after swallowing. The side where this occurs and whether there is clearance after subsequent swallows without food should be determined. Laryngeal penetration occurs when the food bolus enters the laryngeal vestibule but remains above the vocal cords; aspiration occurs when the food content enters the respiratory airways, below the level of the vocal cords. Posterior premature spillage and

eventual aspiration sometimes occur with the inadvertent passage of food residue from the oral cavity to the larynx after swallowing.

Additionally, data on sex, age at the time of the evaluation, symptom that led to the assessment, comorbidities, and complications associated with the procedure were collected from patients submitted to VFSS. VFSS was performed by a pediatric radiologist and a speech therapist, and at least three swallows were evaluated for each tested food consistency. Like FEES, VFSS is a non-invasive exam that allows for detailed observation of the anatomic structures and the physiology of all stages of swallowing, with a temporal relationship. It uses radiation and therefore requires the ingestion of different volumes and consistencies of foods dyed with barium that form part of the child's usual diet, according to each age group. All pharyngeal-laryngeal structures should be visualized before the exam, and the exam should begin with a latero-lateral incidence, which is ideal for this purpose. Essentially, the exam assesses the following: 1) time parameters: the measurement of the time from the formation of the food bolus until it reaches the stomach (in s or ms), 2) movement of the hyoid bone (in mm), and 3) presence of anterior and/or posterior food spillage. Several other parameters may be evaluated and measured in this exam, depending on the disorder, including the presence or absence of oral and/or pharyngeal residue after swallowing, nasopharyngeal regurgitation, tracheal aspiration, and even gastroesophageal reflux and the precise moment of its occurrence. The presence or absence of the cough reflex can also be assessed.⁵ The duration of the oropharyngeal stage of swallowing is less than 2 s; the possibility of reproducing the collected images for later analysis is therefore considered an advantage for the diagnosis and clinical management of children with swallowing disorders. VFSS should simulate a normal meal and should therefore be performed while the patient is standing or sitting. Infants can be slightly reclined.

The procedures followed the regulations established by the directors of the Commission for Clinical and Ethical Research and were in accordance with the World Medical Association Declaration of Helsinki.

Results

A total of 278 children were evaluated in larynx consultation between 2018 and 2020. Of these, only 71 (26%) had swallowing impairment; these patients comprised the study sample. The patients' ages ranged between 0 years and 18 years. Not all children who exhibited swallowing impairment during the follow-up period underwent complementary exams, mostly because their complaints did not persist for more than 3 months. FEES and VFSS were performed in 17 (24%) and 23 (32%) children, respectively, and seven children (10%) underwent both.

Of the 17 patients who were submitted to FEES, 53% were male and 47% were female. Their ages ranged between 5 months and 16 years (with a mean age of 3 years).

All children who underwent FEES presented symptoms compatible with swallowing disorders, and some had more than one symptom that led to the evaluation. The most frequent symptom was choking during eating, which occurred in 76% of cases. Additionally, nine patients (52%) also complained of dysphagia, four patients refused to eat (24%), and an associated laryngeal disorder was suspected in three patients (18%).

Of the 23 patients who underwent VFSS, 65% were male and 35% were female. Their ages ranged between 1 month and 12 years (with a mean age of 3 years).

As in the children who underwent FEES, the most frequent symptom in those who were submitted to VFSS was choking during eating, which occurred in 60% of cases. Additionally, eight patients (34%) refused to eat, and two patients (9%) had a history of recurrent pneumonia.

We did not report complications associated with the FEES or VFSS procedures, and the exam was stopped whenever significant

laryngo-tracheal aspiration occurred. Of the 71 children with swallowing impairments, 28% had two or more overlapping diagnoses in the following etiological categories: neurological, structural, cardiorespiratory, genetic, gastrointestinal, and metabolic. Structural anomalies were the most common cause of laryngomalacia (39% of cases).

With regard to the associated diagnoses, 35% of the 17 children who underwent FEES had more than one disorder, and 35% of patients in this group had laryngeal structural anomalies, namely laryngomalacia and vocal cord paresis. In decreasing order of frequency, three patients (18%) had a neurological disorder with psychomotor development impairment, two patients (12%) had a genetic disease (Down syndrome and Aicardi-Goutières syndrome), two patients had a cardiorespiratory disease, and two patients had a gastrointestinal disease (eosinophilic esophagitis and gastrointestinal reflux). Only one patient (6%) had metabolic disease with mitochondrial dysfunction. Three children required partial or total nasogastric tube (NGT) feeding.

We present two clinical cases that demonstrate the usefulness and feasibility of FEES in children of different ages. Both children also underwent VFSS, which provides information complementary to that of the endoscopic exam.

Clinical Case 1

Case 1 involves a 10-year-old boy with a diagnosis of Schwannoma of the left cerebellopontine angle. He complained of dysphagia, choking, and nasal regurgitation since the surgical intervention to remove the tumor. An NGT tube was placed for feeding. Otorhinolaryngology examination and FEES showed soft palate paresis on the left that prevented palate closure, significant salivary stasis with deficient secretion clearance after a swallow, and apparent secretion aspiration. No changes in vocal cord mobility were observed. The patient exhibited a marked decrease in pharyngeal and laryngeal sensitivity, with a reduced cough reflex. The

test using semisolid food showed abundant food residue and laryngeal penetration even after several swallows (Figure 1). The patient received speech therapy to train swallowing, and he improved gradually over the course

Figure 1
Initial FEES in Case 1

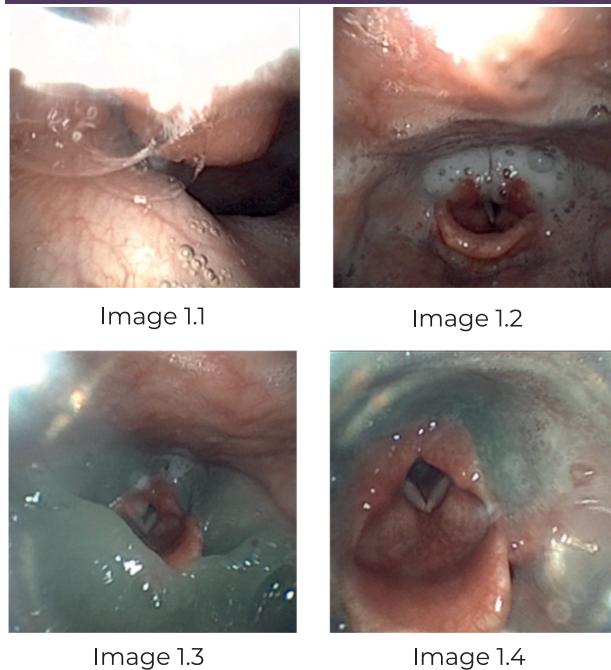


Figure 2
FEES after swallowing training in Case 1

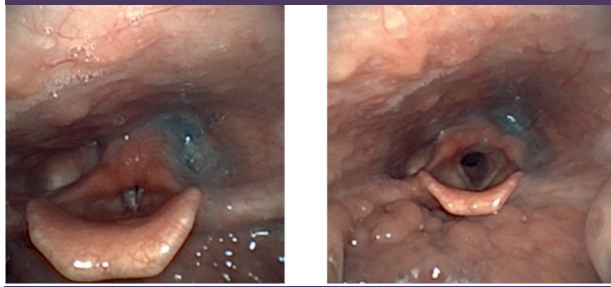
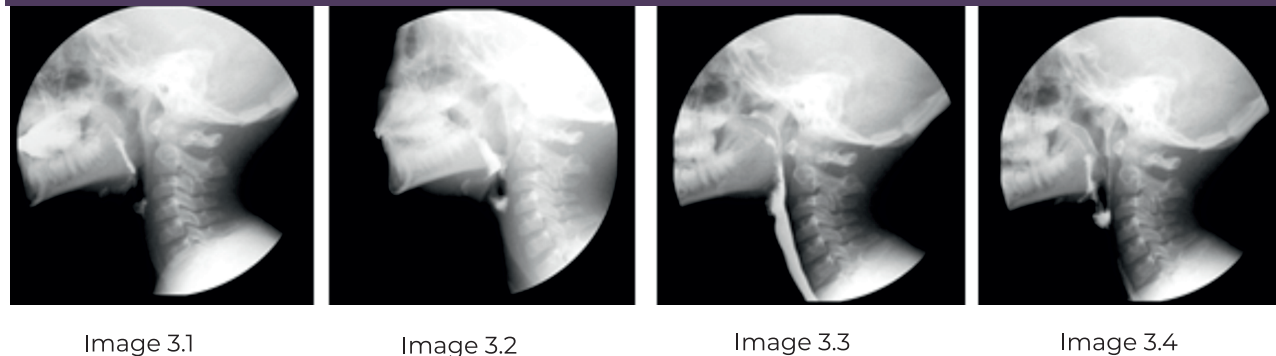


Figure 3
Initial VFSS in Case 1



of 3 months. He repeated the evaluation with FEES, which showed a decrease in salivary stasis, persistent food residue that disappeared after successive swallows, and mild laryngeal penetration. No laryngo-tracheal aspiration occurred, and it was safe to remove the NGT (Figure 2).

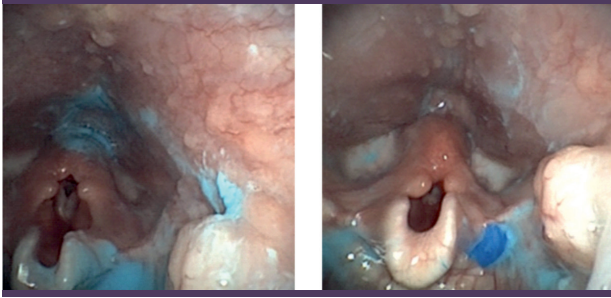
Incomplete closure of the soft palate (Image 1.1); stasis, penetration, and aspiration of secretions into the glottis in the arytenoid region and posterior commissure (Image 1.2); food residue and penetration of food content without clearance even after successive swallows (Images 1.3 and 1.4)

Oral stage with adequate characteristics (Image 3.1); oropharyngeal transition with posterior spillage, with delayed elevation of the hyolaryngeal complex (Image 3.2); velopharyngeal insufficiency, with reflux of the contrast agent into the nasopharynx (Image 3.3); pharyngeal-esophageal segment with moderate change in contractility, with exuberant stasis at the vallecular and pyriform sinus level (Image 3.4).

Clinical Case 2

Case 2 involves a 16-month-old girl with a diagnosis of Aicardi-Goutières syndrome, with delayed psychomotor development and frequent episodes of choking. Objective examination showed the hypopharynx and larynx without morphological or functional changes. FEES showed moments of lack of coordination at the beginning of swallowing. Oral control is evaluated within a short interval of time, and it is sometimes difficult to observe

Figure 4
FEES in Case 2



the occurrence of posterior spillage. This patient had food residue and mild laryngeal penetration but no aspiration of food content. Food residue disappeared after three swallows. The exam was performed during crying, with the inherent difficulties, and three consistencies were tested using foods normally fed to the child (milk, yogurt, and rice). The child also underwent VFSS, which showed delayed elevation of the hyolaryngeal complex and maintenance of posterior spillage, but the airway was always protected. Food residue and mild laryngeal penetration, without laryngo-tracheal aspiration for the different food consistencies.

Discussion

Swallowing disorders affect approximately 1% of children every year in the United States. Despite the impact of the disease, only a minority of those affected seek care, which suggests that this is a problem that is self-limited over time in the pediatric population or that parents/caregivers overlook the symptoms and, as such, do not seek assistance from health care providers to address the child's swallowing problems.⁷ In recent years, medical/surgical advances have allowed an increase in the diagnosis of these disorders in the pediatric population.³

Only 26% of the 278 children assessed in larynx consultation over the 3-year period were included in this analysis, namely those who had a swallowing impairment. Generally, the onset of swallowing impairment among children occurs, on average, at 8 years of age.⁷ In children with laryngeal functional

impairment, swallowing and potential aspiration problems often become evident at 2–3 years of age because the ability to swallow develops significantly during the first year of life, and at 2–3 years, the larynx descends, with respiration and swallowing occurring in the area at that point.¹ In the present analysis, the mean age of the children submitted to FEES was 3 years old, and most had laryngeal disease, which is in line with the reviewed literature.

The causes of swallowing impairment in childhood are varied, and almost all problems related to eating are multifactorial. Approximately 80% of children with delayed development have eating difficulties.^{6,8} The majority of patients with severe eating disorders have a medical condition and/or an associated congenital and/or acquired developmental condition, such as structural anomaly of the aerodigestive system, neuromuscular disease/developmental disorder, genetic disease, or cardiorespiratory, gastrointestinal, or metabolic disease.^{4,6} In the present study, 28% of children with swallowing impairments had two or more overlapping diagnoses in the different etiological categories.

Swallowing disorders are common among children with laryngomalacia, regardless of the severity of the disease or the presence of associated comorbidities. Even without symptoms of dysphagia, these children often have normal swallowing studies.⁹ Laryngomalacia was an associated diagnosis in 39% of the assessed patients.

Dysphagia is classified into oropharyngeal and esophageal dysphagia. Oropharyngeal dysphagia describes problems in the passage of the food bolus from the oral cavity to the esophagus and results from muscle or sensory impairments or structural defects of the oral cavity, pharynx, and upper esophageal sphincter. The signs/symptoms related to the oropharyngeal stage of swallowing are difficulty initiating swallowing, choking or coughing during eating, and a sensation of having food in the throat after several swallows.² In the present study, the sign that

led to evaluation via FEES in most patients was choking during eating.

Notably, a history of respiratory symptoms such as intermittent stridor, wheezing, or recurrent pneumonia may be due to chronic aspiration during eating. FEES is a valuable tool for the evaluation of the pharyngeal stage of swallowing as it provides information about the anatomy and physiology of that stage of swallowing, the sensitivity of the pharynx and larynx, the integrity of airway protection, and the ability to clear secretions.^{1,2,4} FEES is based on observation of the swallowing of foods of different consistencies/textures during flexible laryngoscopy and is considered a minimally invasive exam that can be performed at the bedside in children of all ages, including those who are breastfeeding.^{3,10,11} Moreover, it facilitates assessment of the sensory aspect of swallowing.¹²

Objective evaluation of children with dysphagia is important because there is a high incidence of silent aspiration.¹³ Endoscopic evaluation of swallowing is important when there is a suspicion of impairment such as food residue, penetration, or laryngeal aspiration.⁶ In the present study, these parameters were assessed in all FEES exams, and the findings informed recommendations for maximum optimization of the oral route and minimization of the risks of pulmonary morbidity caused by aspiration. The gold standard method for the evaluation of this type of disorder continues to be VFSS, in which the child is given foods of different consistencies mixed with barium. The radiographic images are subsequently visualized in a way that allows dynamic evaluation of the anatomy and physiology of the four stages of swallowing.^{1-3,6} Although this exam is non-invasive, it has the disadvantage of exposing the child to radiation.⁵ Some therapeutic strategies may be used during the exam itself, for example, changing the consistency of the food so that it is better tolerated and does not elicit symptoms of aspiration or changing the position of the head to improve dysphagia, which is surely an advantage.

The decision to perform VFSS and/or FEES is determined according to each patient's needs and the specific issues that need to be addressed. Complementary exams should be considered. The order in which these exams are performed may vary depending on the questions that need to be answered, which, in turn, would depend on the child's clinical presentation. For example, FEES should be performed first if there is suspicion of obstruction of the upper airway and dysphagia.³ This is probably the reason we observed that most patients who underwent FEES had laryngeal disease. In the present study, most patients underwent VFSS, while seven patients (10%) were submitted to both exams. The decision is always multidisciplinary and personalized according to each clinical case.

The adaptation of adult FEES protocols to the pediatric population began about 20 years ago. Studies conducted over the years have demonstrated the viability and usefulness of performing FEES in children, as well as the safety of the procedure. Some authors report its equivalence, in terms of results, to VFSS, with descriptions of the use of FEES in a variety of specific conditions and at different ages.^{4,10-13} Only Da Silva et al. have shown a low diagnostic correlation between FEES and VFSS.¹⁴ The indications for performing FEES in children according to the protocol established in our institution are summarized in Table 1.

FEES is considered advantageous for the detection of anatomic, sensory, and functional changes, as well as for the assessment of secretion control.^{4,6} It can be performed in children of all ages, either in the physician's office or in the ward. An important advantage of FEES relative to VFSS is that the child is not exposed to radiation; FEES can therefore be performed repeatedly, both for serial evaluations and for observation of the effect of some therapeutic maneuvers, when used in a multidisciplinary context and with the help of a speech therapist. Other advantages are that it does not require a contrast agent, only foods the child normally eats are used,

Table 1
Indications for performing FEES in children

Indications for performing FEES in children

Chronic dysphagia
Known/suspected pharyngeal disease (preoperative evaluation of swallowing, postoperative evaluation of the risk of aspiration)
Patients with risk of/suspected aspiration
Patients with secretion control problems
Patients with an abnormal VFSS or who are unable to undergo VFSS (oral route for negligible amounts, intolerance to positioning), or as a control exam, avoiding exposure to radiation

and taste is not altered. Moreover, the exam can be performed while the child is in their usual feeding position,^{3,4} thus facilitating assessment of the protection of the airway during breastfeeding, which is not possible with VFSS.^{4,10} However, there are some limitations in the assessment of the oral and esophageal stages of swallowing.^{3,4,12}

The use of FEES in children requires knowledge of the disorder associated with dysphagia, congenital and/or acquired conditions, and pharyngeal-laryngeal anatomy and function,

which changes throughout the child's development.^{3,4,12} There exist specificities related to the use of FEES at different ages that should be known, namely: 1) The diameter of the endoscope varies, with the smallest (2.0 mm) being reserved for the neonatal period or for anatomical narrowing. 2) Some authors recommend including visual distraction strategies such as video clips. 3) A nurse's assistance is recommended to stabilize the head during changes of head position throughout the exam. 4) Breastfeeding

Table 2
Comparison of FEES and VFSS in children

	FEES	VFSS
View	From top to bottom, view of the hypopharynx/larynx	Sagittal, i.e., view from the mouth to the esophagus
Anatomy	Clear view of the hypopharynx and larynx	More structures are viewed but with less detail
Contrast	Food dye (methylene blue)	Barium (changes the flavor of the presented foods)
Swallowing	View disappears temporarily: white-out effect during swallowing Allows assessment of the pharyngeal stage of swallowing, essentially	Allows assessment of all stages of swallowing (oral, pharyngeal, and esophageal)
Secretions	Assesses the characteristics and pooling of secretions and the patient's response to secretions	Not assessed
Mobility of the vocal cords	Assesses phonation and the cough reflex	Not assessed
Exposure to radiation	No exposure to radiation Allows for serial evaluations	Exposure to radiation
Patient age	Can be performed at any age	Cannot be performed during breastfeeding

infants exhibit a rhythmic and rapid sequence of suction/swallowing/respiration in which the endoscopic view is lost. This is a significant limitation to the interpretation of FEES, and training is required to evaluate the protection of the airway under these conditions. 5) In older children, the initiation of swallowing may be more easily visualized and interpreted if small amounts of milk/food are presented (using a syringe/spoon).⁴

The complications associated with FEES in children are epistaxis, which is mostly self-limited, and vasovagal reactions.^{4,6} In the present analysis, there were no complications associated with the procedure.

Conclusion

In patients with a severe clinical condition, instrumental evaluation of swallowing is essential to exclude aspiration and laryngopharyngeal anatomic defects because it provides unique information. FEES in children has specific characteristics, with the advantage of avoiding the use of radiation or contrast agents. VFSS has the advantage of facilitating more effective assessment of the anatomy and physiology of all stages of swallowing, especially the oral and esophageal stages, which is not possible with FEES.

VFSS and FEES are thus considered the complementary diagnostic exams of choice for the study of swallowing disorders. Their indication depends on multidisciplinary, personalized, and thorough evaluation, and their use and interpretation require considerable knowledge and experience.

Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

Data Confidentiality

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

Protection of humans and animals

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the 2013 Helsinki Declaration of the World Medical Association.

Funding Sources

This work did not receive any contribution, funding or scholarship.

Availability of scientific data

There are no datasets available, publicly related to this work.

Bibliographic references

1. Streppel M, Veder LL, Pullens B, Joosten KFM. Swallowing problems in children with a tracheostomy tube. *Int J Pediatr Otorhinolaryngol*. 2019 Sep;124:30-33. doi: 10.1016/j.ijporl.2019.05.003.
2. Castro E, Fonseca L, Matos J, Bernardo T, Silva AP. Videoendoscopia da deglutição: Protocolo de avaliação. *Rev Port ORL*. 2012 Set;50(3): 197-204 doi: 10.34631/sporl.112.
3. Arvedson JC, Lefton-Greif MA. Instrumental assessment of pediatric dysphagia. *Semin Speech Lang*. 2017 Apr;38(2):135-146. doi: 10.1055/s-0037-1599111.
4. Miller CK, Willging JP. Fiberoptic endoscopic evaluation of swallowing in infants and children: protocol, safety, and clinical efficacy: 25 years of experience. *Ann Otol Rhinol Laryngol*. 2020 May;129(5):469-481. doi: 10.1177/0003489419893720.
5. Anéas GCG, Dantas RO. A videofluoroscopia da deglutição na investigação da disfagia oral e faríngea. *GE J Port Gastreenterologia [Internet]* 2014 Jan; 21(1):21-5. Available from: <https://doi.org/10.1016/j.jpg.2013.11.004>
6. Borowitz KC, Borowitz SM. Feeding Problems in infants and children. *Pediatr Clin North Am*. 2018 Feb;65(1):59-72. doi: 10.1016/j.pcl.2017.08.021.
7. Bhattacharyya N. The prevalence of pediatric voice and swallowing problems in the United States: Pediatric Voice and Swallowing. *Laryngoscope*. 2015 Mar;125(3):746-50. doi: 10.1002/lary.24931.
8. Schwemmler C, Arens C. [Feeding, eating, and swallowing disorders in infants and children: an overview]. *HNO*. 2018 Jul;66(7):515-526. German. doi: 10.1007/s00106-017-0388-y.
9. Simons JP, Greenberg LL, Mehta DK, Fabio A, Maguire RC, Mandell DL. Laryngomalacia and swallowing function in children. *Laryngoscope*. 2016 Feb;126(2):478-84. doi: 10.1002/lary.25440.
10. Reynolds J, Carroll S, Sturdivant C. Fiberoptic endoscopic evaluation of swallowing: a multidisciplinary alternative for assessment of infants with dysphagia in the Neonatal Intensive Care Unit. *Adv Neonatal Care*. 2016 Feb;16(1):37-43. doi: 10.1097/ANC.0000000000000245.
11. Vetter-Laracy S, Osona B, Roca A, Peña-Zarza JA, Gil JA, Figuerola J. Neonatal swallowing assessment using fiberoptic endoscopic evaluation of swallowing (FEES).

Pediatr Pulmonol. 2018 Apr;53(4):437-442. doi: 10.1002/ppul.23946.

12. Sitton M, Arvedson J, Visotcky A, Braun N, Kerschner J, Tarima S. et al. Fiberoptic endoscopic evaluation of swallowing in children: feeding outcomes related to diagnostic groups and endoscopic findings. *Int J Pediatr Otorhinolaryngol.* 2011 Aug;75(8):1024-31. doi: 10.1016/j.ijporl.2011.05.010.

13. Pavithran J, Puthiyottil IV, Kumar M, Nikitha AV, Vidyadharan S, Bhaskaran R. et al. Exploring the utility of fiberoptic endoscopic evaluation of swallowing in young children – a comparison with videofluoroscopy. *Int J Pediatr Otorhinolaryngol.* 2020 Nov;138:110339. doi: 10.1016/j.ijporl.2020.110339.

14. da Silva AP, Lubianca Neto JF, Santoro PP. Comparison between videofluoroscopy and endoscopic evaluation of swallowing for the diagnosis of dysphagia in children. *Otolaryngol Head Neck Surg.* 2010 Aug;143(2):204-9. doi: 10.1016/j.otohns.2010.03.027.