Clinical benefits of FEES in the diagnosis and management of dysphagia patients

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Abstract. Clinical benefits of FEES in the diagnosis and management of dysphagia patients. A comprehensive, well-executed and well-interpreted FEES examination can result in excellent evaluation and treatment planning for patients with dysphagia and/or aspiration. This review will look at the state-of-the-art technique, the interpretation, the predictive value and the safety of FEES.

Introduction

Oropharyngeal dysphagia is associated with a high degree of morbidity, mortality and costs for both the patient and the community. The sparse epidemiological data show that the prevalence of dysphagia in persons aged over 50 years ranges from 16 to 22%, increasing to up to 60% of residents in long-term care facilities. The consequences of oropharyngeal dysphagia can be serious: dehydration, malnutrition, aspiration, choking, pneumonia and death. Demographic developments will bring more clinicians into contact with dysphagia, increasing the need for both dysphagia evaluation and rehabilitation. This article will focus on the possibilities provided by modern flexible fibre optics in the evaluation and treatment of oropharyngeal swallowing disorders.

History of endoscopy and the Fiberoptic Endoscopic Evaluation of Swallowing (FEES)

Flexible nasopharyngolaryngoscopy was introduced to otolaryngologists in 1968. It first appeared in clinical practice in the 1970s and, over the years, slowly gained acceptance. Significant technological improvements in the 1980s yielded smaller-diameter telescopes with improved optics and lightweight recording equipment that attached easily to the endoscope, making the instrument much more useful.

Flexible endoscopy as a procedure for assessing oropharyngeal dysphagia was first described in 1988. Initially, it was referred to as FEESS, or fiberoptic endoscopic evaluation of swallowing safety, as the editor of the journal indicated that the swallowing function per se could not be evaluated, only swallowing safety could. FEESS was presented as an alternative to the videofluoroscopic evaluation of swallowing (VFES), indicated only when fluoroscopy was not available. Gradually, FEES has been accepted as a full procedure for the evaluation of pharyngeal swallowing. In 1997, a trademark was approved for the acronym FEES. FEES is not a screening procedure, and the term FEES should not be used when endoscopy is performed simply to identify dysphagia or aspiration. It is also distinct from a laryngeal examination to diagnose medical pathology. The procedure consists of a complete evaluation, including an assessment of the anatomy and physiology of the pharyngeal and laryngeal muscles; an assessment of the swallowing function; and a therapeutic examination to determine which postural, dietary, and behavioural strategies might facilitate safer and more efficient swallowing.

After several years of research, innovative technology developed by Aviv et al. led to the description of the FEESST procedure (fiberoptic endoscopic evaluation of swallowing with sensory testing). This procedure augments FEES by directly testing sensory thresholds in the laryngopharynx using calibrated air pulses as a mechanical stimulus.

FEES protocol

For FEES to yield accurate results, it must be administered comprehensively. The purpose of the examination is to identify the patient’s swallowing physiology and determine the types of oral intake appropriate for a patient. If a patient is a candidate for oral feeding, the next objective is to determine the safest and least
restrictive diet. During the study, the effects of changes in bolus size, bolus texture, patient positioning and compensatory manoeuvres on bolus flow are evaluated to determine optimum swallowing safety and efficiency. The average FEES examination requires approximately 10 to 20 minutes of active assessment.

Technique

Material
Endoscope
It is very important to secure the position of the endoscope at the patient’s nostrils, particularly in patients who may be impulsive or unpredictable. An impulsive patient who moves forward quickly to accept a bolus from a spoon may cause the scope to move farther into the hypopharynx than the endoscopist intends, exacerbating the risk of mucosal laceration, perforation, or laryngospasm. Similarly, a distracted patient may look to the source of a sudden sound or conversation and inadvertently dislodge the scope from the nasal cavity. The alert endoscopist should be wary of such potential behaviours and be able to anticipate.

Chip camera with visualisation on external monitor
Although FEES can be performed without a chip camera and external monitor, several elements of the examination may be compromised. The close proximity of the endoscopist to the patient’s mouth may not only be intimidating, it also can encumber feeding. The endoscopist cannot observe the patient’s feeding behaviours or monitor the volume or consistency of new boluses as they are presented. The liberty of movement for the endoscopist as well as the patient is very limited, and precludes the repositioning of the patient further limiting the ability to examine the usefulness of manoeuvres or compensatory positioning. The strain for both endoscopist and patient will also increase, limiting the possibility of a comfortable examination. Finally, if aspiration occurs, the endoscopist may well have a good amount of bolus coughed onto his or her face or clothes.

Video documentation
FEES(ST) without videotape recording relies on subjective interpretation and documentation, thereby diminishing the validity and reliability of conclusions. Videotape recording of endoscopies allows for the objective identification and documentation of details that cannot be appreciated by the unaided eye in real time. Recording on video tape ensures the repeatability of the gauging progress in the recovery of swallow function and eliminates examiner subjectivity. Additional benefits are the correct documentation of changes resulting from treatment; the enhancement of teaching for patients, families, and other health-care workers; keeping archive records; the possibility of allowing more than one specialist to view the procedure; the opportunity for the repeated observation of the same event; quantitative and qualitative visual explanations of the data and disorders; and the opportunity for visual feedback training.12

Imaging the swallow using flexible endoscopy
During FEES, the endoscope is placed directly in the path of the bolus as it traverses the pharyngeal cavity. Although this often allows excellent visualisation of the bolus transit through the pharynx, the anatomic movements and sometimes the bolus itself may, in turn, move the endoscope and conceal the view of structures. The skilled endoscopist anticipates bolus movement and anatomic movements and actively positions the scope to minimise concealment and maximise findings. The major elements affecting optimum visualisation are velar elevation, base of tongue contraction, and clouding of the distal lens with bolus residuals or oropharyngeal secretions.

Velar elevation
The velum has a double role during the swallow; it initially contains the bolus in the oropharynx and later protects the nasopharynx from bolus intrusion. With proper positioning in the nasopharynx, elevation of the velum and closure of the nasopharyngeal seal can be visualised well in order to identify for normalcy or dysfunction.

Throughout the swallowing examination, the tip of the endoscope is generally kept in position between the soft palate and the tip of the epiglottis, where the entire larynx and both pyriform sinuses are visualised, allowing for the optimum detection of premature spillage of a bolus and/or a delay in swallowing initiation. In this position the velum will not be in view, but the movement of the velum will contribute to changes in the visualisation of events before, during, and after the swallow. During the swallow, the tongue and velum contact the posterior pharyngeal wall. If the distal tip of the scope is positioned high
enough, the body of the velum will trap the objective lens against the posterior wall during elevation. The visual effect is that of a bright flash of light, also known as ‘whiteout’, which results from light that is reflected off the tissue. This period of concealment is equal to the time that the tissue is opposed to the objective lens and lasts approximately half a second in normal subjects. To the novice endoscopist, this period of concealment is perhaps the most daunting anomaly of the endoscopic examination because it occurs at the height of the pharyngeal stage of the swallowing. Many anatomical movements will be obscured during the whiteout. Because the clinician will not be able to observe these movements directly, evidence of their movement must be inferred.

Base of tongue

When the distal tip of the scope is positioned at the level of the epiglottis, it is more likely that the base of the tongue will trap the scope against the posterior pharyngeal wall and result in whiteout. When placed this low, the scope is also likely to come in contact with the bolus as it is advanced through the pharynx, introducing the risk of the objective lens becoming clouded. In swallows with normal amplitude, this presents few problems because the tongue base acts to scour the objective lens as the distal tip of the scope is pushed against the posterior wall. In cases where the amplitude of tongue base retraction is reduced or the pharyngeal constrictors are weakened, residue can remain in the pharynx following the swallow. In cases of low placement, this residue can cloud the objective lens, resulting in a reduction in clarity or, worse, the complete concealment of the pharynx.

Clearing the clouded objective lens

When the objective lens becomes soiled as a result of contact with oropharyngeal secretions, food, or liquids, steps must be taken immediately to clear the material so as not to miss events as they unfold. The first step is to retract the scope by about 1 to 3 centimetres to prevent inadvertent advancement of the distal tip of the scope into the trachea or contact with the mucosal surface of the larynx and epiglottis. If this retraction does not clear the lens effectively, the endoscopist can wait for a spontaneous swallow or elicit a swallow from the patient. If this measure fails, a light flexion of the angulation control lever will move the objective lens against the posterior pharyngeal wall, probably releasing the material. If all else fails, the scope should be retracted from the patient and cleaned with water until the lens system is clear before reinsertion and resumption of the examination. Avoiding soiling of the objective lens is the best way to prevent an obstructed view. If the patient has clinical signs of a weakened swallow or copious secretions in the hypopharynx, the objective lens can be kept in a position so that the velum, and not the tongue base or bolus, will make contact with the objective lens during whiteout. After the patient has finished swallowing the bolus, the endoscopist passes the endoscope inferiorly into the laryngeal vestibule so that the subglottis is visualised. This allows for the optimum detection of laryngeal penetration and aspiration. Once the trachea has been visualised, the endoscope is pulled back to the pre-swallow position so that the tip of the endoscope does not touch the larynx during laryngeal elevation with phonation and/or further swallows.

Pre-swallow tasks

Before administration of a food bolus, the endoscopist evaluates the different sphincters and propulsive forces involved in swallowing: velopharyngeal sphincter, pharyngeal contraction (‘pharyngeal squeeze’), base of tongue mobility, laryngeal mobility (adductory and abductory tasks), and evaluation of glottic and supraglottic closure mechanisms.

FEESST (Flexible Endoscopic Evaluation of Swallowing with Sensory Testing)

Introduction

In 1993, Aviv et al. introduced the FEESST procedure, supplementing the standard FEES protocol with the evaluation of laryngopharyngeal sensitivity. Technically, the sensory testing consists of the endoscopic administration of discrete pulses of air to the laryngeal mucosa innervated by the superior laryngeal nerve using a calibrated air pulse generator. One of the shortcomings of FEES and VFES is that these diagnostic tests primarily analyse the motor component of swallowing, but only indirectly analyse the sensory component. Unrecognised, or insufficiently recognised, sensory deficits in the laryngopharynx can result in insufficient detection of food and secretions, so that normal laryngopharyngeal protective
reflexes will not be properly initiated, resulting in secretions and debris descending both into the oesophagus and the tracheobronchial tree. The radical departure during FEESST is the assessment of airway protection capacity before giving food or barium to a patient, in other words to assess airway protection before moving apotential foreign body to a patient’s airway. The sensory capacity of the laryngopharynx can be assessed with psychophysical testing and by eliciting the laryngeal adductor reflex.

Psychophysical testing

With this technique, subjective reporting by the patient about feeling a particular air stimulus is used to determine the sensory threshold. A potential shortcoming of the psychophysical technique is that the patient may misunderstand instructions. A particular concern is that patients with cognitive or neurological impairments might not indicate that they feel the stimulus at the threshold value but at some higher value.

Laryngeal Adductor Reflex (LAR)

Stimulation of the mucosa innervated by the superior laryngeal nerve elicits the LAR. The LAR is defined as a brief, rapid, non-rhythmic and transient vocal fold adduction after stimulation of the SLN, which is clearly distinguishable from the rhythmic vocal fold movement seen during normal respiration. Since the difference between psychophysical and sensorimotor reflex thresholds is not statistically significant, the LAR can be used as an objective measure of the sensory capacity of the laryngopharynx, allowing for the use of the LAR method in patients with a variety of cognitive deficits.

Clinical relevance

General sensitivity

Laryngopharyngeal sensitivity – like the oral cavity – undergoes a physiological ‘aging process’; there is a statistically significant difference in sensitivity between individuals older and younger than 60 years of age. Surgical intervention in the head and neck region can result in sensory deficits (e.g. supraglottic laryngectomy, reconstruction with myocutaneous flaps). Neurological conditions also can have a profound impact on laryngopharyngeal sensitivity.

‘Silent sensory deficits’

Dysphagia is a common and devastating complication in stroke patients, with possible lethal outcome as a result of aspiration pneumonia. In addition to this clinically overt subgroup, there are stroke patients without subjective or objective findings of dysphagia who display ‘silent laryngopharyngeal sensory deficits’. This is different from ‘silent aspiration’ in which patients complain of dysphagia and objective evaluation shows aspiration of food without eliciting a cough reflex or any other outward sign of difficulty by the patient. A study by Aviv et al. shows that these silent laryngopharyngeal sensory deficits are predictive for aspiration pneumonia. These ‘unrecognised’ sensory defects form a greater threat to the patient than a ‘recognised’ silent aspiration because neither the former patients nor their caregivers will be aware of a possible dysphagia until there are recurrent bouts of aspiration pneumonia.

Association between laryngopharyngeal sensory deficits, pharyngeal motor function, and the prevalence of aspiration

There is a strong association between laryngopharyngeal motor and sensory integrity; even with an intact motor execution of the swallow, good sensory function is essential, although some authors question the importance of laryngopharyngeal sensory deficits. This observation is supported by the work of Aviv et al., Bastian et al., and Sulica et al. In clinical experience, most patients with normal pharyngeal motor function are usually safe to consume puree consistencies regardless of laryngeal sensory capability. However, there is a clear need to determine the integrity of laryngopharyngeal sensation before recommending the oral consumption of liquids. The prevalence of the aspiration of thin liquids in patients with intact motor function and severely diminished or absent laryngeal sensation is high at between 15 and 40%. However, nearly all individuals with severe sensory and motor function will aspirate thin liquids. Therefore patients with poor pulmonary reserve, absent pharyngeal motor function, and severely diminished or absent laryngeal sensation should not be unnecessarily exposed to thin liquids, since aspiration is highly probable.

Bolus administration

Food can be administered to the patient using large variations in consistency, bolus size and speed. For safety reasons, bolus administration at each level of bolus vis-
Viscosity begins with small amounts and ends with challenging swallows, like continuous feeding or drinking, as long as no penetration or aspiration can be seen. If aspiration is observed (and if this is not gross aspiration), a bolus of the same viscosity, size, and type is administered again to determine whether the patient still demonstrates aspiration. If aspiration is observed a second time, the patient is failed for that bolus viscosity and bolus size. If a patient does not aspirate using a particular bolus viscosity, the examiner must challenge the patient at that bolus viscosity with multiple bolus volumes and trials. In other words, the examiner assesses a bolus size at each bolus viscosity several times before officially ‘passing’ the patient for that viscosity, because the particular swallowing mechanism may break down with fatigue and may become jeopardised with increases in irregular breathing patterns while eating. The examiner should therefore assess all bolus viscosities and bolus sizes in a fatiguing or challenging environment. FEES is particularly useful for this procedure since the duration is not limited by any concerns about radiation exposure.

Interpretation of FEES findings

As noted, the purpose of FEES is to identify swallowing physiology, not simply penetration and aspiration. However, when penetration or aspiration is seen, it is important to determine when it occurs. In other words, does the aspiration occur before, during, or after the swallow? Identifying the timing of aspiration facilitates the understanding of a particular patient’s swallowing physiology. Once the breakdown in swallowing physiology is identified, a swallowing rehabilitation plan may be developed.

Aspiration before swallow

Pre-swallow aspiration is usually a result of posterior oral spillage and/or a delay in swallowing initiation. Posterior oral spillage is identified as parts of the bolus falling piecemeal into the pharynx before the swallow. This is an oral-phase problem. The posterior tongue and the soft palate are not approximating during the oral phase to keep the bolus contained in the oral cavity during oral preparation.

It is not unusual for the bolus to reach the level of the pyriform sinuses before swallow initiation in a non-dysphagic person but a patient with a delay in swallowing initiation allows the entire bolus to be pushed into the pharynx lingually and the bolus pools in the pharynx and/or pyriform sinuses for a prolonged period without swallowing. A dwell time longer than 2 seconds is considered to be abnormal. A delay in swallowing initiation may result in aspiration before or during the swallow. This delineation is made when the bolus is seen to pass the glottis before pharyngeal contraction (i.e. ‘whiteout’). In other words, if the bolus enters the trachea before ‘whiteout’ begins, aspiration is before the swallow. Delay in swallowing initiation may be secondary to a delayed motor response and/or decreased sensory acuity of the pharynx. Again, it is important to determine the presence and/or absence of these physiological parameters because swallowing rehabilitation is guided by these findings.

Aspiration during swallow

If no aspiration is observed before ‘whiteout’ but the bolus is visualised in the subglottis and/or trachea after ‘whiteout’, aspiration has occurred during the swallow. Aspiration during the swallow is typically a result of insufficient airway protection. First, aspiration may occur during the swallow because laryngeal closure mechanisms are delayed relative to the head of the bolus travelling through the pharynx. Second, aspiration may occur during the swallow because of the breakdown of one or more of the laryngeal closure mechanisms: true vocal fold closure, false vocal fold closure, arytenoids to epiglottic approximation, and aryepiglottic fold stiffening. The pre-swallow tasks (i.e. holding breath, phonatory tasks, and so on) provide the examiner with information relative to the integrity of laryngeal closure.

Aspiration after swallow

If the swallow is completed but material residing in the vallecula or pyriform sinuses falls into the airway, aspiration is occurring after the swallow. This material may originate from post-deglutition residue or hypopharyngeal reflux. Residue and subsequent aspiration after the swallow usually occur secondary to decreased or uncoordinated pharyngeal contractions that leave part of the bolus in the pharynx after the upper oesophageal sphincter has closed. In addition to this impaired motor function, decreased laryngopharyngeal sensation may allow a bolus to ‘lie unnoticed’ in the pharynx with resultant post-swallow aspiration. When the pharyngeal squeeze
seems clinically sufficient, a primary dysfunction of the upper oesophageal sphincter could be the cause, in which case insufficient sphincter relaxation must be distinguished from insufficient passive opening. Finally, hypopharyngeal reflux may regurgitate a bolus that has been completely swallowed to the pharynx. Causes may be oesophageal peristaltic disorders or Zenker’s diverticulum.

Compensatory techniques

Compensatory techniques are implemented once the physiological cause of the dysphagia is identified. These techniques are always tested for effectiveness and are not just routinely implemented, but only when they result in improved swallowing. The endoscopist should realise that it is difficult if not unrealistic for some patients to implement these (complex) techniques throughout an entire meal. Initial research also highlights some risks in the implementation of certain techniques in, for example, cardiac patients.

Diet recommendation guidelines

FEES provides the examiner with objective information about the bolus sizes and consistencies that a patient can safely consume. Furthermore, because FEES can thoroughly challenge the swallowing mechanism, there is little guesswork in recommending an appropriate diet that is neither too liberal (meaning dangerous) nor conservative. These recommendations improve the perceived quality of life, even during the acute phase of dysphagia. Unnecessary dietary restrictions tend not only to reduce the quality of life but also reduce oral intake, possibly resulting in dehydration and malnutrition.

False negative rate

One of the perils of clinical dysphagia practice with potentially devastating consequences is the inability to identify subjects at high risk. One measure of this risk is the false negative rate (FNR), which determines the failure of a test to identify a group at a high risk for a disease. A study by Leder et al. determined the identification of aspiration risk in acute stroke patients using either a clinical examination or FEES. The FNR for the clinical evaluation was 14%; the false positive rate was 70%. Not only is the false positive rate too high, resulting in unnecessary dietary or compensatory modifications, including the (costly) transition of peroral to non-oral medication, the FNR of 14% is also a cause of much greater concern because this is the number of patients who are inadvertently hurt. These results are strongly supported by previous work addressing the prediction of aspiration pneumonia in acute stroke patients with dysphagia.

Examination safety

The use of flexible endoscopy does not lead to any increased risk for either the endoscopist or the patient. The potential risks associated with endoscopy include gagging, laryngospasm, vasovagal syncope, adverse reactions to topical anaesthetic, and epistaxis. Aviv et al. and Cohen et al. reported that in a series of 500 and 350 consecutive FEESST procedures, there were no incidents of laryngospasm or vasovagal responses and there were only seven patients with epistaxis, all self-limiting.

Role of topical anaesthetic during Flexible Endoscopic Evaluation of Swallowing

Effect of anaesthetic on discomfort during FEES/FEESST

The use of topical anaesthetics and/or vasoconstrictors and their effect on the patient’s comfort during transnasal flexible laryngoscopy (TFL) has been widely studied. Patient comfort and tolerance for the procedure are paramount given the time needed for a comprehensive examination. The administration of anaesthetics and/or decongestants can be considered, since the associated risks are minimal, and in the light of their potential (although not proven) benefit on the patient’s comfort and tolerance for the procedure.

Effect of anaesthetic on swallowing

The use of topical anaesthetics during FEES has attracted criticism because anaesthetics applied to the nostrils may drip into the oropharynx or laryngopharynx. Desensitisation of these areas may
interfere with the afferent pathways needed to trigger an appropriately timed swallow and may hinder appropriate motor responses. Multiple studies conclude that the application of significant or excessive topical anaesthetic negatively affects swallowing function and could increase the risk for dysphagic patients of aspiration during FEES.31

**Benefits of FEES**

FEES has many advantages for the assessment of swallowing capabilities compared to VFES.

**Bedside**

FEES is portable and can be performed at a patient’s bedside or in an office, an intensive care unit, or in a long-term care facility. Furthermore, patients who are on a regimen of mechanical ventilation, contact precautions, in traction or the like can have their swallowing assessed with FEES without waiting to be cleared from precautions or being placed at undue risk. FEES minimises waiting times for both diagnostic procedures and treatment. The time needed for the FEES procedure is similar to a bedside clinical examination; there is no need for additional staff as there is with VFES. FEES saves time, money and effort without sacrificing accuracy.

**Pharyngeal secretions**

FEES allows the visualisation of pharyngeal secretions that cannot be detected during VFES. Murray et al.32 assessed the significance of accumulated oropharyngeal secretions. They reported that the ‘accumulation of endoscopically visible oropharyngeal secretions located within the laryngeal vestibule was highly predictive of aspiration.’ The examiner can also identify the source of the pooled secretions. Generally, pooled secretions are the result of either decreased vegetative swallowing frequency or dysphagia, or both. One can assess a patient’s swallowing frequency to determine whether swallowing frequency is the cause of the pooling.

**Sensitivity testing**

By contrast with the FEESST procedure, VFES only allows for indirect conclusions about laryngopharyngeal sensitivity. Methods like inhaling tartaric acid to elicit a cough reflex are a poor substitute.

**Food items**

FEES allows the use of any food substance, without any need for mixing with radio-opaque substances.33 This allows the patient or carers to conduct a specific examination of the food consistencies, bolus sizes, etc. that elicit the dysphagia.

**Population**

FEESST can easily be performed in patients with cognitive deficits (e.g. dementia or mental retardation), with positioning difficulties (e.g. stroke, postoperative patients), and so on. These patients are a significant subgroup of the dysphagia population for whom there are no significant impediments during FEESST.

**Sampling error**

FEES makes it possible to study a larger number of swallows. In patients with high levels of variability during consecutive swallows, this prolonged observation allows for a reduced ‘sampling error’. With VFES, there is an inherent time limit to the study, which often prevents the assessment of the effect of fatigue on swallowing. Patients with dysphagia, however, often have a longer feeding duration, and many symptoms only emerge at the end of the meal with the onset of fatigue. Where VFES is terminated prematurely due to massive aspiration, FEES makes it possible to establish a more detailed picture of the anatomy and physiology of the patient, even without administering food, by observing the management of secretions and allowing for a more adapted bolus, both in consistency and size.

**Biofeedback**

The endoscopic examination allows for excellent biofeedback during therapy. This is particularly useful during instruction procedures for compensatory techniques for the correct understanding and execution of the techniques.34

**Follow-up**

FEES is highly suitable for follow-up examinations whenever a re-evaluation is deemed necessary due to the evolution of the dysphagia, either for better or worse.35

**Assessing the efficacy of therapeutic interventions**

Although both FEES and VFES can be used to assess the efficacy of a certain therapeutic intervention, there are some significant advantages to the use of FEES in many patients. There are no time limits to the study duration, allowing the examiner to try different interventions without fear
Education

A thorough education and the enhancement of compliance for the patient, the carers and other health-care professionals are of the utmost importance in the management of dysphagia. Nonetheless, these persons may, for a number of reasons, reject a well-structured and tailored therapy proposal. FEES makes it possible – as does VFES – to visualise an aspiration episode directly. However, FEES can be readily performed in the presence of family, nursing staff and other health-care professionals, allowing the salient findings to be discussed in real time with the attendees; with VFES, only retrospective discussion is possible due to radiation concerns for the attendees.

Cost

A final problem – which is becoming more important – is the cost; generally speaking VFES costs about twice as much as FEES(ST).

Which evaluation method: FEES or VFES?

The decision as to which examination is indicated is made on the basis of the patient, medical, clinical and logistic considerations, and clinical experience and evidence-based studies in the literature. Tables 1 through 4 highlight some of the advantages and indications for both FEES and VFES.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Assessment of different parameters during FEES(ST) and VFES</th>
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<tbody>
<tr>
<td>Item</td>
<td>FEES(ST)</td>
</tr>
<tr>
<td>Velopharyngeal function</td>
<td>excellent</td>
</tr>
<tr>
<td>Vocal fold mobility</td>
<td>excellent</td>
</tr>
<tr>
<td>Sensation</td>
<td>excellent</td>
</tr>
<tr>
<td>Anatomical detail</td>
<td>excellent</td>
</tr>
<tr>
<td>Spilling</td>
<td>excellent</td>
</tr>
<tr>
<td>Pooling</td>
<td>excellent</td>
</tr>
<tr>
<td>Penetration</td>
<td>excellent</td>
</tr>
<tr>
<td>Aspiration</td>
<td>good</td>
</tr>
<tr>
<td>Hypopharyngeal reflux</td>
<td>excellent</td>
</tr>
<tr>
<td>Laryngeal elevation</td>
<td>good (*)</td>
</tr>
<tr>
<td>Pharyngeal squeeze</td>
<td>excellent</td>
</tr>
<tr>
<td>Oral cavity</td>
<td>good (**)</td>
</tr>
<tr>
<td>Latency</td>
<td>good</td>
</tr>
<tr>
<td>Proximal oesophagus</td>
<td>moderate</td>
</tr>
</tbody>
</table>

FEES(ST), Fiberoptic/Flexible Endoscopic Evaluation of Swallowing with Sensory Testing; VFES, Videofluoroscopic Evaluation of Swallowing.

(*) through palpation of neck
(**) direct inspection during clinical examination.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Clinical application of FEES(ST) and MBS during dysphagia assessment</th>
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<tbody>
<tr>
<td>Disorder</td>
<td>FEES(ST)</td>
</tr>
<tr>
<td>Initial workup</td>
<td>good</td>
</tr>
<tr>
<td>Oesophageal pathology</td>
<td>poor</td>
</tr>
<tr>
<td>Cranial neuropathy</td>
<td>excellent</td>
</tr>
<tr>
<td>Post-operative anatomy</td>
<td>excellent</td>
</tr>
<tr>
<td>Rapid progressive disorder</td>
<td>excellent</td>
</tr>
<tr>
<td>Bedridden patient</td>
<td>excellent</td>
</tr>
<tr>
<td>Biofeedback</td>
<td>excellent</td>
</tr>
</tbody>
</table>

FEES(ST), Fiberoptic/Flexible Endoscopic Evaluation of Swallowing with Sensory Testing; VFES, Videofluoroscopic Evaluation of Swallowing.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Indications for FEES</th>
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<tbody>
<tr>
<td>–VFES not available when the examination is needed or is not available at all</td>
<td></td>
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<tr>
<td>–Transportation to VFES would put the patient at risk, multiple monitors or ventilator in place, additional staff needed to travel with patient</td>
<td></td>
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<tr>
<td>–Transportation to an outside hospital is problematic: cost of transportation, personnel to accompany patient, strain on patient,…</td>
<td></td>
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<tr>
<td>–Concern about excess radiation exposure (especially with children)</td>
<td></td>
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<tr>
<td>–Positioning for VFES is problematic (e.g. contractures, quadriplegia, decubitus ulcers, neck halo, obese, on ventilator)</td>
<td></td>
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<tr>
<td>–Patients with severe dysphagia: weak, infrequent, or possibly absent swallow and/or limited ability to tolerate aspiration, concern about aspiration of barium, food, or liquid</td>
<td></td>
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<tr>
<td>–Question of ability to swallow secretions, aspiration of secretions</td>
<td></td>
</tr>
<tr>
<td>–Postintubation or postsurgery, when altered laryngeal anatomy or function is possible</td>
<td></td>
</tr>
<tr>
<td>–Associated dysphonia</td>
<td></td>
</tr>
<tr>
<td>–Need to assess laryngopharyngeal sensation</td>
<td></td>
</tr>
<tr>
<td>–To assist with medical diagnosis when laryngeal anatomy/function is critical</td>
<td></td>
</tr>
<tr>
<td>–Need for an extended therapeutic examination (manoeuvres, positions, food consistencies…)</td>
<td></td>
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<tr>
<td>–Use of endoscopy as biofeedback tool</td>
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</table>
Is there a ‘gold standard’?

Historically, VFES has been considered the ‘gold standard’ against which every other procedure was evaluated. Multiple comparative studies of VFES and FEES have shown a high degree of concordance for the salient findings. In recent years, only one prospective study was published comparing both examinations. Aviv found no statistically significant difference in the prevalence of aspiration pneumonia during a one-year follow-up of 126 patients with different aetiologies of dysphagia. Subgroup analysis of stroke patients, however, showed that FEES-guided management resulted in a statistically significant reduction of aspiration pneumonia when compared to VFES-guided management.

Conclusion

FEES provides correct identification of the pathophysiology of oropharyngeal dysphagia, allowing an appropriate and tailored therapy to maximise safe oral feeding. The examination is well tolerated and well accepted by all patients and is readily available and within the scope of every otolaryngologist.

References

12. Gallivan GJ. FEES/FEESSST and videotape recording: there’s more to this than meets the eye. *Chest*. 2002;122:1513-1515.


