

Fiberoptic Endoscopic Evaluation of Swallowing Protocol

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OBJECTIVES

- 1) To identify patients with major alterations of swallowing safety (aspiration of food below the vocal cords, or penetration of food into the laryngeal vestibule).
- 2) To identify patients with oropharyngeal dysphagia requiring diet modifications in order to improve swallowing safety and ensure nutritional requirements.
- 3) To identify patients requiring an alternate feeding route (i.e. nasogastric tube, gastrostomy or jejunostomy among others) because of severe aspiration or inability to receive their nutritional requirements by an oral route.
- 4) To guide swallowing rehabilitation for patients with oropharyngeal dysphagia.
- 5) To obtain the maximum diagnostic yield of the Fiberoptic Endoscopic Evaluation of Swallowing.

DEFINITIONS

“Oropharyngeal dysphagia” refers to deglutition alterations due to abnormalities in the oral or pharyngeal phases of swallowing.⁽¹⁻⁶⁾ This may happen because of mechanical or functional alterations in any structure of the mouth, larynx, or pharynx (i.e. nasopharynx, oropharynx, or hypopharynx).⁽¹⁻⁸⁾ Patients may also have dysphagia due to mechanical or functional abnormalities in the esophageal phase of swallowing, in which case we talk about esophageal dysphagia.⁽²⁻⁷⁾

The Fiberoptic Endoscopic Evaluation of Swallowing with Sensory Test (FEES) is performed using a thin fiberoptic endoscope with a working channel of 1.2 mm.⁽⁹⁾ The endoscopist introduces the endoscope through the patient’s nasal cavity. It is lubricated with water-soluble gel to decrease discomfort. The endoscopist does not use anesthetics because the FEES only produces mild to moderate discomfort, it is infrequently associated

with pain, and anesthetics might alter the reflexes needed for deglutition and measurement of their thresholds.

The swallowing evaluation assesses the efficiency and safety of deglutition while the patient eats foods of four different consistencies: solid, semi-solid, thick liquid, and thin liquid. Alterations of swallowing safety include aspiration, penetration, premature spillage and pharyngeal residues. Alterations of swallowing efficiency refers to delays in bolus transit from the mouth to the stomach or other alterations on the deglutition physiology not necessarily compromising swallowing safety. Definitions of these abnormalities are detailed below.

When the patient has severe alterations in swallowing safety, however, it might be necessary to stop all oral feeding and select an alternate method of feeding (e.g. nasogastric tube or gastrostomy).

STAFF AND TASKS

The FEES is performed by a team of professionals, consisting of a pulmonary or ENT doctor, a speech-language pathologist (SLP), and a clinical assistant.^(9, 10)

First, the endoscopist explains the FEES and its potential benefits and risks to the patient undergoing the test and his relatives. Afterwards, the endoscopist obtains the written informed consent of the patient and/or his relatives. The endoscopist performs the FEES in collaboration with an SLP (both present during the test).

During the test, the SLP gives food to the patient, performs a clinical examination of the patient's swallowing, looking at the external movements of oral structures during the preparatory phase of swallowing and then looking at the video-endoscope monitor during the oral and pharyngeal phases of swallowing to assess the efficiency and safety of the patient's swallowing.

A clinical assistant helps during the test, preparing the equipment, adjusting the equipment settings and providing secretions toilet (if necessary) during the test.

INDICATIONS FOR FEES

- Symptoms of oropharyngeal dysphagia, including coughing, choking, a wet voice, throat clearance, or dysphonia during or after swallowing^(1, 7, 11)
- Aspiration pneumonia, recurrent pneumonia, pulmonary infiltrates consistent with aspiration^(7, 12)

CONTRA-INDICATIONS FOR FEES

Most FEESST contraindications are relative and include:^(1, 8-10, 13-15)

- Severe respiratory failure

- Bleeding diathesis

RISKS ASSOCIATED WITH THE FEES

The FEES is a safe procedure. It produces moderate discomfort, but adverse events are infrequent, occurring in less than 0.2% of cases. Its complications include: ^(9, 13, 15)

- Nasal bleeding (epistaxis): less than 0.1% of procedures ^(13, 15)
- Lightheadedness (caused by vagal reflex): rare reports ⁽¹⁴⁾

PATIENT PREPARATION FOR THE FEESST

Nothing by mouth (*nil per os*, or NPO) before the FEESST is not strictly required because patients who undergo the procedure receive food by mouth during the test. However, two hours of fasting may be helpful to promote appetite and facilitate reception of food during the test.

EXAMINATION ROOM

The FEES does not require special patient monitoring. It can be done bedside or in a clinical office, endoscopy room, operating room, emergency room, or intensive care unit, among other places. ^(1, 8, 9, 13-15)

EQUIPMENT

1. Fiberoptic endoscope
2. Light source
3. Head camera for video-endoscopy
4. Image processor
5. Computer
6. Suction instrument
7. Oxygen source (during FEES the endoscope internal lens is cleaned with oxygen injected through its working channel instead of aspirating secretions).
8. Oxygen tubes
9. Examination gloves

10. Sphygmomanometer and stethoscope
11. Drinking water
12. Food of different consistencies: cow milk for thin liquids, nectar for thick liquids, puree for semisolids and Graham cracker for solids.
13. Green food coloring
14. Bib
15. Straws, 2.5 cc spoon, 10 cc spoon, 200 cc plastic cups

MONITORING

Vital signs measurement.

DURATION

One hour (includes the installation of equipment, staff preparation, clinical evaluation of the patient, explanation and procurement of informed consent, and elaboration of the test's report).

PROCEDURE

1. Explain the procedure and its benefits and risks to the patient; obtain written informed consent.
2. Install and check the correct functioning of all the equipment for the test. This includes centering the head camera on the endoscope eyepiece, connecting the head camera to the image processing system, and verifying the light and image quality and functioning of the recording software.
3. Wash hands and put on protective elements (i.e. facial mask, gown, cap).
4. Place the patient in a seated position. Patients who are unable to sit can be evaluated in a semi-reclined position.
5. Conduct nasal, mouth, and pharynx inspection. This examination allows the endoscopist to choose the nostril he will use to introduce the endoscope and to detect any abnormalities that could potentially affect swallowing.
6. Lubricate endoscope using water-soluble gel. The patient will not receive anesthetics.
7. Remove the patient's nasogastric tube, if he has one. At the end of the exam, the endoscopist can put the

nasogastric tube back in, if needed.

8. Introduce the fiberoptic endoscope through the nostril and the inferior meatus. Inspect the nasal cavity, nasopharynx, oropharynx, larynx, and hypopharynx (Figure 1). Then evaluate the handling, clearance, and characteristics of upper aerodigestive secretions and the functionality of the upper aerodigestive tract during phonation (saying “ee” in English or “ii” in Spanish), breathing (10 seconds of normal breathing and 10 seconds of panting), and dry swallowing (including the frequency of dry swallows). ^(16, 17)

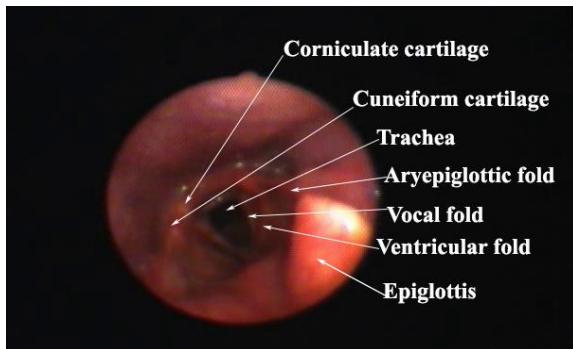


Figure 1. Larynx, endoscopic anatomy.

9. During the exam, ensure that the endoscopic view is clear. When the endoscope view becomes foggy, the endoscopist could try injecting air or oxygen through the working channel of the endoscope to clear the view. If necessary, the endoscope could be removed for cleaning and then reintroduced.
10. If the epiglottis is backward and does not allow for a view of the glottis, move the epiglottis forward by asking the patient to say “ee” (“ii” in Spanish) or asking him to move his mandible forward. Rate the amount and clearance of secretions according to Table 1. This table is an aid to describe with precision the most relevant alterations on upper aerodigestive secretion clearance, based on the work of Langmore and Murray. ^(16, 18) It is different from the Murray scale. ⁽¹⁶⁾

Table 1. Upper aerodigestive tract secretion clearance

Rate, by consensus between the endoscopist and the SLP, the amount and handling of secretions as:

0. Normal: wet pharynx (Figure 2)
1. Accumulation of secretions outside the laryngeal vestibule (Figure 3)
2. Penetration of secretions: secretions enter into the laryngeal vestibule (Figure 4)
3. Aspiration of secretions: secretions pass below the vocal folds into the trachea (Figure 4)

In case of penetration or aspiration of secretions, rate the patient's reaction according to the corresponding letter:

- A. The patient reacts with coughs or clearing maneuvers
- B. The patient does not react (silent penetration or aspiration of secretions)



Figure 2. Normal pharynx (wet).



Figure 3. Accumulation of secretions outside the laryngeal vestibule.



Figure 4. Penetration and aspiration of secretions.

SWALLOWING EVALUATION DURING THE FEES

To perform the swallowing evaluation during FEESST, the SLP gives the patient green-colored food of four different consistencies: thick liquid, semi-solid, solid, and thin liquid (Figure 5). A Graham cracker provides the needed solid-food consistency for the test, and it is covered with green puree to provide the green coloring (Figure 5). All of the foods were colored green with food coloring in order to improve their endoscopic visibility.

The patient receives at least three boluses (here “bolus” refers to the volume of food that the patient receives in his mouth) of every food consistency. The SLP gives the food to the subject using a spoon or, in the case of liquids, using a straw and a cup. The volume of bolus is progressively increased from 2.5 cc to 10 cc.



a)

b)



c)

d)

Figure 5. Food consistencies used for the endoscopic evaluation of swallowing: a) Semi-solid (Puree); b) Solid (Graham cracker covered with green puree for coloring); c) Thin liquid (milk); d) Thick liquid (nectar consistency). All of the foods were colored green with food coloring in order to improve their endoscopic visibility.

During this part of the FEES, the SLP performs a clinical examination of the patient's swallowing, observing how the patient receives and processes food in his mouth, including all aspects of the oral preparatory phase of swallowing that may be evaluated by external observation, such as lip closure, suctioning, and chewing; duration of oral preparatory phase; and the amount of residue left in the oral cavity after swallowing. The alterations of the oral preparatory phase are reported according to Table 2.

Table 2. Alterations in the oral preparatory phase

1. Mouth opening: rated as normal or limited.
2. Sweeping foods presented in spoon: rated as normal, mild compromise, moderate compromise, or severe compromise.
3. Straw suctioning: rated as normal, mild compromise, moderate compromise, severe compromise, or not evaluable.
4. Lip closure: rated according to external observation of lips during food processing in the oral cavity (i.e. looking for food spillage through lips) as normal, mild compromise, moderate compromise, or severe compromise.
5. Chewing: rated according to external observation of mouth during chewing of food as normal, mild compromise, moderate compromise, or severe compromise.

During the FEES the SLP also observes the laryngeal movements on the endoscope monitor to see how the patient handles food during the pharyngeal phase of swallowing. The endoscopist also continuously observes the endoscope monitor in order to assess the efficiency and safety of the patient's swallowing. The endoscopist and the SLP determine by consensus the presence and severity of swallowing abnormalities.

During swallowing evaluation the endoscope tip is placed at two sites:

- a. Basal or swallowing observation position: The endoscope tip is just above the epiglottis. The field of view includes the hypopharynx, larynx, and the base of the tongue (Figure 6).
- b. Laryngeal approach position: The endoscopist asks the patient to stop swallowing and places the endoscope tip close to the larynx. The field of view includes the laryngeal vestibule, glottis, and subglottic region (Figure 7). This position is useful for seeing if there are any signs of penetration (food residue in the laryngeal vestibule) or aspiration (food residue below the vocal cords) after swallowing.

Before the start of swallowing, the endoscopist places the fiberoptic endoscope at the basal position, and after swallowing, the endoscopist places it at the laryngeal approach position (Figures 6 and 7).⁽¹⁹⁾

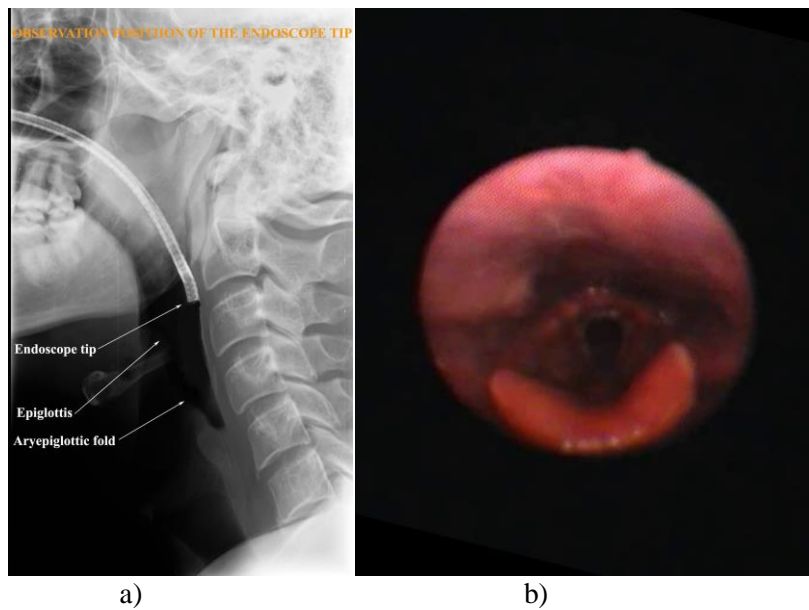


Figure 6. Basal or swallowing observation position: a) Position of the tip of the endoscope in the upper aerodigestive tract; b) endoscopic view.

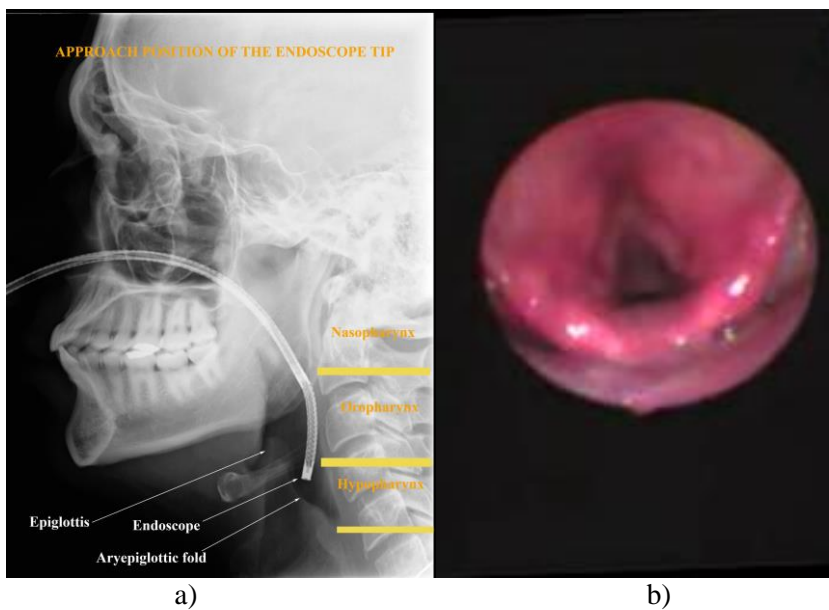


Figure 7. Laryngeal approach position: a) Position of the tip of the endoscope in the upper aerodigestive tract; b) endoscopic view.

Alterations in the Oropharyngeal Deglutition Efficiency During FEES

The evaluation of swallowing during FEESST includes looking for the following alterations in the deglutition

efficiency:

1. Delay in oral preparatory phase: rated as normal, mild compromise, moderate compromise, or severe compromise.
2. Delay in oral transport phase: rated as normal, mild compromise, moderate compromise, or severe compromise.
3. Food residue in oral cavity after swallowing: rated as no residue, mild residue, moderate residue, or severe residue.
4. Delay in swallowing reflex triggering: rated according to the point at which the swallowing reflex was triggered ^(1, 18) (Table 3).
5. Pharyngeal contraction: ^(1, 18) rated according to the degree of pharyngeal contraction (Table 4).
6. Laryngeal elevation during swallowing: rate as normal, mild compromise, moderate compromise, or severe compromise.

Table 3. Swallowing reflex triggering

The swallowing reflex is classified by consensus between the expert endoscopist and the SLP as:

0. Normal: the swallowing reflex is triggered by the bolus at the base of tongue.
1. Mild delay of swallowing reflex: the swallowing reflex is triggered when the food has reached the valleculae.
2. Moderate delay: the swallowing reflex is triggered when food reaches the hypopharynx.
3. Severe delay: the swallowing reflex is triggered when the food reaches the upper esophageal sphincter.

Table 4. Pharyngeal contraction
<p>The pharyngeal contraction is rated by consensus between the expert endoscopist and the SLP as:</p> <ol style="list-style-type: none">0. Normal: the endoscopic view disappears completely during swallowing. The food is not seen entering the pharynx, and there is no laryngo-pharyngeal residue after swallowing.1. Mild to moderate compromise: there is some degree of pharyngeal contraction, but the contraction is not complete and the endoscopic view is not lost during swallowing. The food is seen entering the pharynx, and laryngo-pharyngeal residue may be present after swallowing.2. Severe compromise: absence of pharyngeal contraction.

Alterations in the Oropharyngeal Deglutition Safety during FEES

The alterations of swallowing safety that are investigated during the FEES include:

1. Premature spillage of bolus from the oral cavity towards the pharynx due to soft-palate incompetence.
2. Residue in the pharynx after swallowing: Rated according to the amount of residue (Table 5).
3. Penetration: entrance of material into the laryngeal vestibule. In case of penetration, it is important to observe the patient's defense mechanism. When the patient coughs or makes a clearing maneuver to clear his larynx, it should be registered as defense present. If the patient does not cough or make any clearing maneuver, this is registered as defense absent (silent penetration).
4. Aspiration: entrance of material below the vocal cords. The degree of aspiration is rated according to the approximate percentage of bolus aspiration (Table 6).

Table 5. Residue severity

The presence of residue in the pharyngeal cavity is rated after a bolus of 10 cc is administered to the patient (here bolus refers to the volume of food that the subject receives in his mouth, measured in a 10 cc spoon). To rate residue severity, the relative volume of residue is subjectively estimated by consensus between the expert endoscopist and the SLP, comparing the volume of residue observed in the laryngo-pharyngeal tract to the bolus administered to the patient (approximate percentage of the bolus) as:

0. Normal: absence of residue.
1. Minimum: material coating the pharyngeal walls.
2. Mild: more than coating but less than 10% of a 10 cc bolus (roughly less than 1 cc).
3. Moderate: between 10% and 20% of a 10 cc bolus (roughly 1 cc to 2 cc).
4. Severe: more than 20% of a 10 cc bolus (roughly more than 2 cc).

Table 6. Aspiration severity

The degree of aspiration is rated by consensus between the expert endoscopist and the SLP, comparing the volume of aspiration observed to the bolus administered to the patient (approximate percentage of the bolus) as:

0. Normal: absence of aspiration.
1. Mild aspiration: aspiration of drops of bolus or any amount lower than 5% of bolus.
2. Moderate aspiration: aspiration of 5% to 10% of bolus.
3. Severe aspiration: aspiration of more than 10% of bolus

In case of aspiration, the defense of the patient is registered as:

- A. Present: the patient coughs or make a clearing maneuver to clear his airway.
- B. Absent: the patient does not cough or make any clearing maneuver (silent aspiration).

Deglutition Postural Techniques and Maneuvers

When the patient presents alterations in swallowing, the SLP may apply the following maneuvers to see if they are useful for compensation: ⁽¹⁴⁾

- a. Chin down (also known as chin tuck or head flexion): The patient tucks his head toward the chest, as much as possible, during swallowing. This technique helps reduce aspiration, especially in patients experiencing aspiration from residue located at the valleculae. ^(20, 21)
- b. Head tilt: This technique is used on patients with unilateral oral or pharyngeal weaknesses to direct food towards the strong side of the mouth. During this technique, the patient tilts his head, trying to touch his ear with his shoulder. ⁽²²⁾
- c. Head rotation (also known as head turn): The patient rotates his head to the right or left during swallowing in order to direct the bolus to the side opposite head rotation. This technique may be helpful in patients with unilateral weakness to direct the bolus toward the strong side of the laryngopharyngeal tract. ^(22, 23)
- d. Mendelsohn maneuver: The patient maintains the laryngeal elevation for at least two seconds during swallowing. This maneuver aims to prolong upper esophageal sphincter opening to help patients with decreased laryngeal movement. ^(24, 25)
- e. Supraglottic swallow: The patient holds his breath before, during, and after swallowing and completes the swallow with a volitional cough. This maneuver is aimed at increasing airway protection in patients with reduced or late vocal-fold closure or delayed pharyngeal swallow. ^(21, 24)
- f. Super-supraglottic swallow: The patient holds his breath while bearing down before, during, and after swallowing and completes the swallow with a volitional cough. ^(24, 25)
- g. Effortful swallow: The patient is asked to swallow hard, increasing the tongue-to-palate contact and the pharyngeal squeeze. This maneuver helps to maintain bolus clearance from the valleculae or pyriform sinuses. ⁽²¹⁾

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