Swallowing is the successful passage of food and drinks from the mouth to the stomach.

**Phases of swallowing**

1- Oral phase:
   a- oral preparatory phase.
   b- oral voluntary phase.

2- Pharyngeal phase.

3- Esophageal phase.

**Oral preparatory phase:**
consists of manipulation of food and its mastication. It necessitates:
- Good lip closure.
- Optimal tone of buccal musculature to prevent falling into sulci.
- Rotatory action of the tongue and the mandible for chewing.
- Palatolingual seal to prevent vallecular spill-over.

**Oral voluntary phase:**
It's a mechanical stage; entails propulsion of the food backwards by the tongue until the head of the bolus reaches the faucial pillars and the tongue base triggering the pharyngeal swallow (involuntary reflexive swallow).

Oral transit time <1sec.
Pharyngeal phase (swallow reflex)= involuntary stage of swallow:

- V-p closure to prevent nasal reflux.
- Laryngeal elevation and forward movement of the hyoid bone (2cm).
- Laryngeal closure to prevent the penetration of food into the laryngeal inlet.
- Pharyngeal peristalsis to propel the bolus clearing any residue.
- Cricopharyngeal opening (UES) allowing the bolus to move into the esophagus.

Pharyngeal transit time: $\frac{1}{2}$- 1 sec.

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Videofluoroscopy (Modified Barium Swallow or Cookie swallow)

- Studies the anatomy and the physiology of oral and pharyngeal phases of swallowing.
- Triggering of the swallowing reflex in relation to the position of the bolus.
- All motor aspects of swallow in both lateral and AP views: movements of the larynx, hyoid bone, tongue base, pharyngeal walls and the cricopharyngeal region.
- Assesses the transit times, speed and efficiency of bolus movements.
- Identification of residue (amount, place), penetration and aspiration.
- Assesses the symmetry of bolus movement (AP view).

Modified Barium Swallow [Cookie swallow]

- Defines management strategies that will improve the dysphagic patient’s swallowing safety or efficiency


Equipment for Videofluoroscopy

Table, Fluoroscopy tube, Monitor & Control room.
Food presentation

The patient is asked to swallow three swallows of each of the following:

(a) 3 ml, 5 and 10 ml **thin liquid** (20% barium sulfate [prontobario H.D.®] and 80% water);
(b) 3, 5, and 10 ml **thick liquid** (50% barium and 50% water);
(c) 3, 5, 10 ml **semisolid** (pudding mixed with barium powder) and
(d) \( \frac{1}{4} \) of a **cookie** (coated with pudding + barium powder)

**Dysphagia**

- Breakdown in any of the phases of normal swallowing → dysphagia.
- Breakdown in any of the sensory or motor events which comprise the oral preparatory, oral and pharyngeal stages of swallowing.

**Causes of Oro-pharyngeal dysphagia**

1. Neurologic, neuromuscular and muscular.
2. Head and neck tumours and malignancies (primary, surgical resection (degree and extent) and reconstruction.
3. Anatomic abnormalities (fibrosis (radiation), tracheostomy).
4. Systemic
5. Pharmacologic
6. Psychogenic.
Subtotal laryngectomy: reduced sensations at oro-pharyngeal isthmus.

Partial glossectomy: reduced deep sensations at tongue base, reduced propulsive power of the tongue. → Delayed triggering of the swallowing reflex. → residue → aspiration before swallow.

* Glossectomy combined with mandible resection can impair laryngeal elevation and cricopharyngeal opening.

* Simental and Carrau (2004): Irradiated patients have reduced oral and pharyngeal functions including longer oral transit times, increased pharyngeal residue, and reduced cricopharyngeal opening times.

* Logemann et al. (2003): Chemotherapy for head and neck cancer can cause mucositis (40%), pain, oral bleeding and ulcers.

Assessment

Aim of the assessment:

• (1) define the nature of the anatomic or physiologic dysfunction(s) in the oral cavity or pharynx which is (are) causing the patient’s swallowing difficulty;
• (2) examine the effectiveness of selected treatment strategies, and
• (3) enable development of a treatment plan. In order to prevent aspiration and pneumonia/ malnutrition and dehydration.

Protocol of assessment

I- Elementary diagnostic procedures.

II- Clinical diagnostic aids.

III- Additional instrumental measures.

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Protocol of assessment (Cont.)

I- Elementary diagnostic procedures:-

*Bed side clinical assessment:*

1- **Patient's interview:** complaint analysis, history of the present illness.

2- **Auditory Perceptual Assessment (APA) of language and speech.**

3- **Clinical examination:** general examination, vocal tract examination, neck examination, neurological examination and observation during trial feeding.
• **Value**: good indicator of oral, pharyngeal and laryngeal anatomy, sensory or motor functions.
• Behavioral, language and cognitive functions.
• Trial feeding if deemed safe for the patient.
• **Disadvantage**: inability to visualize the larynx and pharynx.

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**Protocol of assessment (Cont.)**

**II- Clinical diagnostic aids:-**

1. **Videofluoroscopy** (Modified Barium Swallow).
2. Videoendoscopy (Fiberoptic endoscopic evaluation of swallowing (FEES)).
3. Formal testing of speech, language, and cognitive abilities.
• **A fiberoptic endoscopic evaluation of swallowing (FEES):** to assess the pattern of disordered swallowing in dysphagia. It involves passing a nasendoscope into the oropharynx where anatomical structures can be directly visualised. The swallowing mechanism can be studied when the patient ingests a small volume of a coloured meal (*Singh and Hamdy, 2006*).

**Clinical findings revealed endoscopically**

Airway closure achieved by true vocal folds (TVFs) adduction, false vocal folds adduction, arytenoids medial and anterior movement.

Mobility of arytenoids.

Amount and location of secretions.

Frequency of spontaneous swallowing.

Aspiration before and after the swallow.

Coordination of bolus flow and airway protection.

Coordination of breathing and swallowing.

Ability to sustain adduction of TVFs for several seconds.

Effectiveness of postural change to alter anatomy and path of bolus flow.
View with fibreoptic endoscopic evaluation of swallowing. (1) Route to oesophagus; (2) trachea; (3) vocal folds; (4) aryepiglottic folds; (5) epiglottis; (6) fluid with green dye.


38 years old female patient, CPA glioma

Delayed triggering of the pharyngeal response
16 years old female patient, post CVA
Premature spillage, delayed triggering of the reflex, residue in valleculae and pyriform sinus.

58 years old male patient (bulbar dysarthria), residue in valleculae remaining after semisolid swallow. Cookie swallow with premature spillage, delayed triggering of the reflex, with peace-meal deglutition and multiple dry swallows.
52 years old female patient, CVA. Residue in pyriform fossae with absent swallow reflex

54 years old male patient, post-supracricoid laryngectomy
Aspiration during swallowing
eg. 1. Massive aspiration after VPL + intact cough reflex
62 years old male patient, total laryngectomy, tracheostomy, misplaced speech valve

52 years old male patient, base of the tongue squamous cell carcinoma, partial laryngectomy, aspiration for thin and thick liquids.
57 years old male patient, post brain stem infarction
**Oral and pharyngeal phases disorders**

9 years old male child, post-removal of brain astrocytoma
Absent pharyngeal reflex, and cricopharyngeal dysfunction with aspiration post-swallow
43 years old male patient, post CVA, bulbar dysarthria
Aspiration during cup drinking (thin)

28 years old male patient, bulbar dysarthria
Severe residue in valleculae and pyriform sinus with cricopharyngeal dysfunction
A-P view.

56 years old male patient, Stroke. Unilateral pharyngeal weakness. Residue in valleculae and pyriform sinuses.

Once the nature of the anatomical/physiological breakdown has been identified the clinician should introduce treatment strategies during the radiographic study in order to obtain a direct evidence of the efficacy of these interventions.
I- Compensatory strategies:

- Postural techniques:
  Introduced first; quick and have a significant impact on the safety and efficiency of the swallow.
  Systematically change the dimensions of the pharynx, direction of food flow without increasing patient’s effort during the swallow.

<table>
<thead>
<tr>
<th>Disorder observed in fluoroscopy</th>
<th>Posture applied if aspiration occurs</th>
<th>Rationale for posture effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inefficient oral transit (reduced posterior propulsion of bolus by tongue)</td>
<td>Head back</td>
<td>Utilizes gravity to clear oral cavity</td>
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<tr>
<td>Delay in triggering the pharyngeal swallow</td>
<td>Chin down</td>
<td>Narrows airway entrance, reducing risk of aspiration; widens valleculae to prevent bolus entering airway</td>
</tr>
<tr>
<td>Reduced posterior motion of tongue base (residue in valleculae)</td>
<td>Chin down</td>
<td>Pushes tongue base backward toward pharyngeal wall</td>
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<tr>
<td>Unilateral laryngeal dysfunction (aspiration during the swallow)</td>
<td>Head rotated to damaged side</td>
<td>Places extrinsic pressure on thyroid cartilage, increasing adduction</td>
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<td>Reduced laryngeal closure (aspiration during swallow)</td>
<td>Chin down</td>
<td>Puts epiglottis in more protective position; narrows laryngeal entrance; Increases vocal fold closure by applying extrinsic pressure</td>
</tr>
<tr>
<td>Unilateral pharyngeal paresis (residue on one side of pharynx)</td>
<td>Head rotated to damaged side</td>
<td>Eliminates damaged side of pharynx from bolus path</td>
</tr>
<tr>
<td>Unilateral oral and pharyngeal weakness on the same side (residue in mouth and pharynx on same side)</td>
<td>Head tilt to stronger side</td>
<td>Directs bolus down stronger side by gravity</td>
</tr>
<tr>
<td>Reduced bilateral pharyngeal contraction (residue spread throughout pharynx)</td>
<td>Lying down on one side</td>
<td>Eliminates gravitational effect on pharyngeal residue</td>
</tr>
<tr>
<td>Cricopharyngeal dysfunction</td>
<td>Head rotation</td>
<td>Pulls cricoid cartilage away from posterior ph. Wall, reducing resting pressure in cricopharyngeal sphincter</td>
</tr>
</tbody>
</table>

Aspiration decreased with head rotation to operated side + chin lowering down position + effortful swallowing
Head forward position

- Sensory enhancement techniques (to increase sensory input):
  - Indications: Delayed triggering of the pharyngeal swallow. Due to impaired propulsive power of the tongue, reduced superficial sensations at oro-pharyngeal isthmus (partial laryngectomy), and reduced deep sensations at tongue base (resection).
  - Sour bolus
  - Cold bolus
  - Increase pressure of the spoon
  - Allowing self feeding
  - Exaggerated suck-swallow (poor saliva control as oral cavity tumours)
  - Thermo tactile stimulation
Thermal stimulation
• Modifications in the manner of feeding:
  Indicated in delay triggering, and weak pharyngeal swallow that require 2-3 dry swallows.
  The amount of food
  The time between swallows
  Reduction of visual and auditory distractions.

• Diet Modification (consistency/viscosity)

• Maxillo - facial prosthetic intervention:
  - Palatal lift prosthesis
  - Palatal obturators
II- Swallowing therapy procedures:

• Indirect swallowing therapy (no food)

• Direct swallowing therapy (with food)
Swallowing maneuvers:

- **Supraglottic**: Deep breath, hold your breath, swallow, cough, swallow. Designed to close vocal folds before and during swallowing. *Zuydam et al (2000)* found that chin down and supraglottic swallow were effective in 50% of the patients who aspirated after resection of the oropharynx including the base of the tongue.

- **Supersupraglottic**: Effortful breath holding, tilts arytenoids forward closing airway before and during swallowing, elevates the larynx. Used in decreased closure of the airway.
- Effortful swallow: Swallow hard. Increases posterior motion of tongue base so improves residue clearance from the valleculae. Used in reduced posterior movement of tongue base.

- Mandelsohn maneuver: It increases the extent and duration of laryngeal elevation \( \rightarrow \) increase the duration of crico-pharyngeal opening.

### III- Surgical management:

- Laryngeal suspension
- Crico-pharyngeal myotomy or dilatation
- Dilatation of the pharynx
- Vocal fold augmentation or medialization
IV- Alternative routes of elimination:

- NG tube
- Gastrostomy
- I.V line

THANK YOU