Swallow, Please!!!
Videofluoroscopic Assessment of Swallowing Disorders
By
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Dedicated to:
Dominique, Cameron, Paul, Maudy, Brigitte, Elias, Tina, Zolia, Pat, Maureen, Bruce, Donna, John, Karen and many other wonderful radiology technologists at the Department of Radiology at Kaiser in Panorama City.
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Thank you!

Overview
- Anatomy and physiology of normal and disordered swallowing.
- Typical progression of a videofluoroscopic evaluation of swallowing (a.k.a. modified barium swallow).
- Working as a team with the speech and language pathologist.
- Conclusion and Q &A
Anatomy and physiology of normal and disordered swallowing

- **Swallowing** (or deglutition) is an intricate process, requiring simultaneous and sequential contraction/relaxation of over 50 muscles. In a normal swallow sensory information is sent and motor information is received from the cortex, cerebellum, brainstem, and cranial nerves (CN I, CN V, CN VII, CN IX, CN X, CN XI, & CN XII).
Terms

- **Penetration** - entry of food or liquid into the larynx at some level down to, but not below the true vocal cords.
- **Aspiration** - the entry of food or liquid into the airway below the level of true vocal folds.
- **Valleculae** - the space between the base of the tongue and the epiglottis, divided into R & L by the hyoepiglottic ligament.
- **Pyriform sinuses** - spaces created between the sides of the larynx and the pharyngeal constrictors (in the hypopharynx).

(Logemann, 1998)

Physiology

- Oropharyngeal swallow is arbitrarily divided into
  - 4 *consecutive stages or phases*:
    1) Oral preparatory
    2) Oral transit
    3) Pharyngeal
    4) Esophageal
Physiology

Oral Phase

Eating is anticipated
Food is brought to the mouth (bitten off, taken from the utensil, sipped or sucked through a straw)
Food is contained and controlled during voluntary mastication:
  - Labial seal prevents anterior spillage of food/liquid;
  - velum is lowered to prevent premature spillage and contain bolus orally;
  - buccal tension keeps the food/liquid out of the buccal sulci
Food is masticated and mixed with saliva forming a bolus

Physiology

Oral preparatory stage

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Physiology

Oral Transit

- Food is collected
- Starts when tongue begins to propel the bolus posteriorly
- Palatoglossal seal is formed: Tongue tip elevates to the alveolar ridge, sides of the tongue elevate laterally to trap the bolus between the tongue and hard/soft palate.
- Bolus is moved posteriorly by the sequential pressing of the lingual muscles
Physiology

**Oral Transit** continued
- Pressure exerted by the tongue increases as viscosity increases (more for solids vs. liquids)
- Oral phase ends when bolus reaches ramus of mandible, faucial pillars, or oral vs. pharyngeal tongue intersect
- Time to complete oral phase is 1-1.5 sec depending on viscosity and age
  - .3 sec longer for persons over 60

**Pharyngeal phase**

- The soft palate elevates - velopharyngeal (VP) closure - in order to prevent food from escaping into the nose.
- Base of tongue (BOT) retracts to contact pharyngeal wall and push the bolus down in a piston-like fashion.
- The hyolaryngeal complex (the larynx suspended from the hyoid bone) moves up and forward.

*When is the swallow triggered during the pharyngeal phase?*
Per Logemann (1998), sometime between the anterior faucial arches and the line of the ramus of the mandible.
Due et al (1997), liquid: 37% at the valleculae, 12% at the laryngeal rim, and 11% not until the bolus reaches the pyriform sinuses.
Solids: 40%, 34%, and 2%.
Physiology

**Pharyngeal Phase** cont.
- Vocal folds (true and false) come together
- Muscles of the pharynx sequentially contract to move the food down towards the esophagus
- The bolus moves inferiorly via a combination of gravity, base of tongue retraction, progressive pharyngeal wall contraction, and pressure differentials.
- The upper esophageal sphincter (UES) that is normally contracted relaxes.
- Food passes into the esophagus

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Physiology

- **Esophageal phase**

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Physiology

**Esophageal Phase**
- UES is pulled open (mechanically) by the anterior excursion of the hyolaryngeal complex (cricopharyngeus muscle is attached to the laminae of the cricoid cartilage)
- Opening of the UES allows the bolus to enter the esophagus
- Opening occurs before the bolus arrives and contributes to the pressure differential within the pharynx
Physiology

Esophageal Phase, cont
- The UES relaxes during the swallow and it is contracted at rest, when not swallowing
- Duration of opening increases as bolus volume increases
- Once in the esophagus, the bolus is carried to the stomach via gravity and esophageal peristalsis- a wave of contraction.
- The lower esophageal sphincter (LES) relaxes to allow the food to pass into the stomach

Dysphagia-Impaired Swallowing
- Impairment in the oral, pharyngeal, and/or the esophageal phases of swallowing
- Broader definition of dysphagia includes impairment in any "...of the behavioral, sensory, and preliminary motor acts in preparation for the swallow, including cognitive awareness of the upcoming eating situation, visual recognition of food, and all of the physiologic responses to the smell and presence of food." (Leopold & Kagel, 1996 as quoted in Logemann, 1998)
Dysphagia

- Dysphagia occurs in all age groups, from newborns to elderly
- Dysphagia can be a result of congenital abnormalities, structural damage/abnormalities, and/or medical conditions (acute or chronic/progressive).

Dysphagia - possible causes

- Causes of dysphagia:
  - Some examples are:
  - CVA,
  - cervical osteophytes,
  - s/p tracheostomy tube placement,
  - CP,
  - brain and head/neck tumor,
  - s/p radiation (recent and remote hx),
  - COPD,
  - rheumatoid arthritis,
  - hiatal hernia
  - cricopharyngeal bars/strictures
  - Zenker's or other diverticulum
  - esophageal narrowing, webs
  - GERD
  - achalasia
  - esophageal dysmotility
  - and progressive neurologic and neuromuscular diseases (Alzheimer's disease, Amyotrophic Lateral Sclerosis (ALS), Parkinson's disease, Postpolio Syndrome, Multiple Sclerosis, Myasthenia Gravis, Muscular Dystrophy, Dystonia)
Dysphagia

- Signs and Symptoms of dysphagia include:
  - inability to recognize food,
  - difficulty in placing the food in the mouth,
  - difficulty manipulating the food/ spillage,
  - poor secretion management,
  - wet/ gurgly vocal quality,
  - coughing before, during, or after swallowing,
  - weight loss in absence of other factors,
  - recurrent pneumonia,
  - sensation of food stuck in the throat after swallowing,
  - and others

Dysphagia

- Oropharyngeal swallowing problems are sometimes the first sign of neurologic disease
- Parkinson’s disease (PD), myasthenia gravis (MG), amyothropic lateral sclerosis (ALS), Guillain-Barre—may initially present with dysphagia

Dysphagia

- Parkinson’s Disease—backward-forward movement of the bolus (rocking-rolling tongue motion), poor laryngeal elevation, reduced BOT retraction
- Myasthenia Gravis—fatigue with repeated swallows
- ALS—reduced lip closure and fine tongue control
Normal Swallowing

Dysphagia

[Images of normal swallowing and dysphagia]
**Additional VFSS clips**

**Videofluoroscopic evaluation of swallowing (VFSS) or Modified Barium Swallow (MBS)**

Typical progression of the study

- **Videofluoroscopy** - "recorded dynamic radiography that utilizes continuous x-rays to assess swallowing function" (ASHA, Guidelines)
**VFSS**

- Purpose: evaluate swallowing, r/o aspiration, determine the swallow physiology causing aspiration, try strategies to improve swallowing, recommend a diet, determine therapy goals, etc.
- Staff needed: radiology technologist and speech pathologist
- Duration: 10-15 minutes average
- Average fluoroscopy time: 2-3 minutes (up to 5 minutes)

**General set up:**
VFSS

- Products Used: barium sulfate by EZ-EM (Bracco Diagnostics Inc.) est. in 1963
  1) Thin liquids
     If needed: Nectar or honey thick liquids
  2) Pureed solids (pudding, apple sauce, or barium pudding)
  3) Mechanical soft/ Regular solids (Lorna Doone cookie, canned fruit)
     May administer all or some of the consistencies depending upon the nature of pt’s dysphagia

VFSS- BARIUM SULFATE

- Barium is a metal ore mined mostly in US, but also around the world.

- It is an extremely inert ingredient and does NOT dissolve in water, stomach acids or gastric juices– it is NOT absorbed by the body.
Liquids are given first
- if aspirated, liquids are most easily expectorated from the lungs and will not block the airway.
Typically want to see at least 2 swallows per consistency.
VFSS

Additional interventions during a VFSS:

**Postural techniques** - changing head and body posture
- head turn (to the weak side)
- chin tuck (to reduce/eliminate premature spillage of liquids or solids into the pharynx)

**Sensory techniques** - heightening sensory input prior to pt's swallow attempts
- Thermal and/or tactile stimulation
- Special boluses (sour, carbonated)

**Swallow Maneuvers** - designed to place specific aspects of pharyngeal swallow physiology under voluntary control (4 types)
- e.g. effortful swallow ("swallow extra hard")
- supraglottic swallow ("hold your breath")

**Last step** - changing food consistency - presentation of thickened liquids

Multiple factors determine which interventions are appropriate for each individual patient. In some cases, all interventions should be attempted before considering a diet modification; in others, none of the interventions are appropriate.
VFSS

- Important! Instructions given during the study:
  - Asking the pt to re-swallow (before the pt has a chance to do so)
  - Asking the pt to hold the liquids/solid foods in the mouth before swallowing
  - Asking the pt to cough
  - etc.
  MAY affect the end result and misrepresent pt’s true swallowing ability

VFSS

Result of the VFSS

- 1) determine presence of dysphagia
- 2) determine PO status: PO or NPO
- 3) recommend a least restrictive diet
- 4) determine impaired swallow physiology and establish individual therapy goals
- 5) refer the patient for further evaluation/treatment as warranted

Working as a TEAM

- Dear Radiology Technologists,
  THANK YOU FOR YOUR EXPERTISE, PROFESSIONALISM, DEDICATION TO PATIENT CARE, and SUPPORT!
### What you should know about Speech Pathologists

We:
- Are grateful to have you!
- Always welcome your input
- Would love to share what we know with you, if you’re interested
- May not know much about radiation exposure and safety
- Need to try whatever is necessary during the study, as its results may significantly affect pt’s quality of life (e.g., NPO)

### Ways to Reduce Radiation Exposure to the Patient

- **ALARA- As Low As Reasonably Achievable**—“limiting the exposure to that needed to achieve the purposes of the procedure” (Lemen, 2004)

### Ways to Reduce Radiation Exposure to the Patient

- Good positioning and a good view
- Video recording
- Explaining the procedure to the patient
- Using a high pulse/continuous setting (more frames per second—ensures that no information is missed, thus, fewer trials are needed)
Ways to Reduce Radiation Exposure to the Patient

- Practicing postures/ maneuvers first
- If appropriate, starting fluoroscopy later (e.g., once the pt has masticated the bolus vs. during mastication)
- If appropriate, stopping before the entire bolus is cleared from the oropharynx

Questions or Comments?????

THANK YOU FOR ATTENDING!!!!

Have a GREAT DAY!!!!!
References


Additional References