AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION

Guidelines for Speech-Language Pathologists Performing Videofluoroscopic Swallowing Studies

ASHA Special Interest Division 13, Swallowing and Swallowing Disorders (Dysphagia)

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About This Document

These guidelines were developed by a working group supported by the American Speech-Language-Hearing Association (ASHA) Special Interest Division 13, Swallowing and Swallowing Disorders. Members responsible for development of the document were Karen Dikeman, Jordan Green, Susan Hiss (chair), Alice Inman, Lisa Kelchner, Cathy Lazarus, and Claire Miller. Amy Hasselkus served as the National Office liaison. Alex Johnson (2000–2002 vice president for speech-language pathology) and Celia Hooper (2003–2005 vice president for speech-language pathology) were the monitoring vice presidents. These guidelines were approved by ASHA's Legislative Council (LC SLP/SLS 11-2003) at their meeting in November 2003. The guidelines follow the executive summary.

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Executive Summary

The American Speech-Language-Hearing Association (ASHA) Scope of Practice in Speech-Language Pathology includes the provision of services by speech-language pathologists (SLPs) to individuals with swallowing (dysphagia) and feeding disorders. According to an ASHA report, 30% of practicing SLPs are involved in the clinical management of dysphagia (ASHA, 2002b). The 2002 ASHA Speech-Language Pathology Health Care Survey indicates that in those settings where SLPs provide services, they are the preferred provider of dysphagia services, with 85% of respondents indicating that they are the only professional in their facility who provides primary dysphagia services (ASHA, 2002c).

Unmanaged oropharyngeal dysphagia is associated with an increased risk of airway obstruction, aspiration pneumonia, death, malnutrition, and a decreased quality of life. The prevalence of dysphagia among individuals older than 50 years ranges from 16% to 22% (Bloem et al., 1990; Lindgren & Janson, 1991). In addition, continued advancements in medical technology have resulted in the survival of an increasing number of medically fragile and high-risk infants and children who frequently present with symptoms of dysphagia and require swallowing evaluation and management.

A swallowing evaluation typically begins with a clinical swallowing evaluation that includes an oralmechanism examination with test boluses as indicated. If clinical signs of oropharyngeal dysphagia are observed during a clinical swallowing evaluation or risk factors are identified, then an instrumental swallowing evaluation may be recommended. Clinical indicators that support the use of an instrumental swallowing evaluation are outlined in the ASHA document, “Clinical Indicators for Instrumental Assessment of Dysphagia” (ASHA, 2000). SLPs employ primarily one of two types of instrumental evaluations: the videofluoroscopic swallowing study (VFSS) and/or the videoendoscopic evaluation (ASHA, 2002a). The information obtained from the clinical and instrumental examinations is used to determine appropriate management and treatment of swallowing disorders and to make appropriate referrals. The implementation of the VFSS requires advanced knowledge and specific skills in order to determine an appropriate test protocol, make real-time decisions regarding management options during the examination, assess oral, pharyngeal, and cervical esophageal swallowing physiology, make specific functional diagnoses and dietary recommendations, and understand issues relative to radiation equipment and safety. The knowledge and skills needed to ensure competency in the area of

videofluoroscopic swallowing studies are outlined in the document, "Knowledge and Skills Needed by Speech-Language Pathologists Performing Videofluoroscopic Swallowing Studies" (ASHA, 2004).

Guidelines

These guidelines address the need for more specific information about VFSS procedures and protocols for serving individuals with dysphagia across all settings and age groups. In this document, training guidelines are offered to assist new and practicing SLPs in acquiring competency in performing a VFSS. The training guidelines address the issues of rationale for performing the examination, populations and possible referral settings, indications and contraindications for performing the assessment, limitations of the procedure, and a suggested test protocol, including therapeutic interventions, documentation, and follow-up. Also, recommended equipment and supplies are discussed, as well as suggested competency measures. Every effort was made to support the guidelines put forth in this document with evidence-based research. However, when research was not available, an expert panel commented and reached consensus on current standards of practice.

In addition, special considerations relative to performing videofluoroscopic swallowing studies are discussed. These special considerations are addressed in this document as they have previously generated questions from professionals on how to appropriately proceed in conducting safe and/or ethical examinations. Special consideration topics include: the need for radiologist participation in the examination, legal and ethical considerations, liquid viscosity issues, considerations for pediatric patients, pharyngoesophageal considerations, radiation safety, and the effect of medications on swallowing ability. These issues are discussed relative to current standards and best practices in the field of speech-language pathology.

In both the training guidelines and the special considerations portions of this document, attention has been given to acknowledging the differences across the life span as it relates to the VFSS. However, identifying all the potential differences across the life span is beyond the scope of this document. The reader is encouraged to review published literature as a resource for appreciation of swallowing and its disorders as it impacts the VFSS from birth through geriatrics.

Introduction

These guidelines are an official statement of the American Speech-Language-Hearing Association (ASHA). The ASHA Scope of Practice in Speech-Language Pathology states that the practice of speech-language pathology includes conducting instrumental swallowing evaluations, including videofluoroscopic swallowing studies (VFSS). The guidelines within this document address the need for more specific information about VFSS procedures and protocols for serving individuals with dysphagia across all settings. It is required that individuals who practice independently in this area hold the Certificate of Clinical Competence in Speech-Language Pathology and abide by the ASHA Code of Ethics, including Principle of Ethics II Rule B, which states: "Individuals shall engage in only those aspects of the profession that are within their competence, considering their level

of education, training, and experience" (ASHA, 2003). Furthermore, individuals should consult state licensure laws regarding speech-language pathologists (SLPs) utilizing the VFSS in their particular state.

Purpose

Given the limitations of the clinical swallowing evaluation, the VFSS is an instrumental exam that identifies oral, pharyngeal, and upper esophageal dysphagia significantly better than the clinical swallowing evaluation (Splaingard, Hutchins, Sulton, & Chaudhuri, 1988; Linden, Kuhlmeier, & Patterson, 1993; McCullough et al., 2000). The purpose of this document is to provide guidelines for the use of the VFSS in the assessment and management of individuals with oral, pharyngeal, and upper esophageal dysphagia. The information contained in this document is intended to build upon an assumed knowledge base in dysphagia assessment and management. This document offers training guidelines to obtain competency in performing the VFSS and addresses questions and issues relative to current best practice in performing a VFSS.

Recommended Training Guidelines

The guidelines that follow outline the information that an SLP needs to possess when conducting the VFSS. This information is presented in the general order that it needs to be considered when completing the evaluation.

I. Rationale for performing VFSS
   - A. To identify normal and abnormal anatomy and physiology of the swallow.
   - B. To evaluate integrity of airway protection before, during, and after swallowing.
   - C. To evaluate the effectiveness of postures, maneuvers, bolus modifications, and sensory enhancements in improving swallowing safety and efficiency.
   - D. To provide recommendations regarding the optimum delivery of nutrition and hydration (e.g., oral versus non-oral, method of delivery, positioning, therapeutic interventions).
   - E. To determine appropriate therapeutic techniques for oral, pharyngeal, and/or laryngeal disorders.
   - F. To obtain information in order to collaborate with and educate other team members, referral sources, caregivers, and patients regarding recommendations for optimum swallow safety and efficiency.

II. General classification of individuals with dysphagia
   - A. Adults.
     1. Acute onset versus chronic or progressive dysphagia.
   - B. Pediatrics.
     1. Congenital, acute onset versus chronic or progressive dysphagia.

III. Referral settings
   - A. Acute care facility.
   - B. Subacute facility.
   - C. Rehabilitation center.
   - D. Long-term acute care center.
   - E. Extended care facility.
   - F. Early intervention program.
   - G. Home health agency.
   - H. Private practice.
   - I. Medical clinic.

J. Private physician office.
K. Developmental center.
L. Educational setting.
M. University clinic.

IV. Indications for VFSS
A. Refer to *Clinical Indicators for Instrumental Assessment of Dysphagia* (ASHA, 2000).

V. Contraindications for VFSS
A. Refer to *Clinical Indicators for Instrumental Assessment of Dysphagia* (ASHA, 2000). Contraindications specific to the VFSS that are not covered in the above document follow.
B. Patient is unable to be adequately positioned.
C. Size of patient prevents adequate imaging or exceeds limit of positioning devices.
D. Allergy to barium.

VI. Limitations of VFSS
A. Time restraints due to radiation exposure.
B. The procedure only samples swallow function and is a limited representation of meal-time function.
C. Contrast issues: Without appropriate contrast, visualization of swallowing is limited. The clinician should be cognizant that increasing the contrast also increases viscosity.
D. Viscosity issues: Using barium may alter liquid and solid food composition. Thus, a lack of correspondence may exist between VFSS test boluses and meal-time food and liquid.
E. Limited evaluation of fatigue effect on swallowing, unless specifically evaluated (Logemann, 1993).
F. Barium is an unnatural food bolus with potential for refusal.

VII. VFSS protocol
A. Patient preparation and positioning.
1. Educate patient and/or caregiver regarding VFSS procedure, radiation safety, and rationale for exam.
2. Individuals are seated upright or in typical eating position to simulate normal ingestion.
3. Infants are typically studied in their usual feeding position (e.g., semi-reclined).
4. Adequate pelvis, trunk, and head supports are utilized as necessary.
5. VFSS may also be performed with individual in side-lying, reclined, supine, or standing, as appropriate.
6. VFSS is typically started with the individual in the lateral view.
7. Individual may also be studied in the oblique and anterior-posterior views.

B. Identify structures at rest.
1. Lips.
2. Dentition.
3. Mandible.
4. Tongue.
5. Velum and velopharyngeal port.
6. Valleculae.
7. Epiglottis.

8. Hyoid.
9. Pharynx.
10. Posterior pharyngeal wall.
11. Pyriform sinuses.
12. Larynx (thyroid, cricoid, arytenoid cartilages).
13. Trachea.
14. Upper esophageal sphincter.
15. Cervical esophagus.
16. Cervical spine.

C. Bolus presentation.
1. Considerable clinical judgment is required to determine the order of bolus presentation as well as potential modifications to or termination of the procedure if the individual appears unable to protect the airway even after the use of therapeutic interventions. A standard protocol is not provided in this document because bolus presentation should be guided by performance, aspiration risk, abnormalities, and patient tolerance.
2. Evaluate viscosity, consistency, and bolus volume effects on swallowing (examples of volumes and viscosities are included below; these lists are not intended to be prescriptive).
3. Viscosity.
a. Thin liquid.
b. Nectar-thick liquid.
c. Honey-thick liquid.
d. Pudding-thick liquid.
4. Consistency.
a. Puree.
b. Soft solid.
c. Hard solid.
d. Mixed consistencies.
e. Other consistencies.
f. Barium tablets.
5. Bolus volumes.
a. Controlled, graduated bolus volumes and rate of presentation (e.g., 1-, 3-, 5-, 10- mL, or ½ tsp, 1 tsp, modifying nipple flow).
b. Discrete cup sips.
c. Sequential cup sips.
d. Sequential swallows during bottle feeding.
e. Straw drinking.

D. Evaluate method and rate of presentation effects on swallowing.
1. Fed by examiner.
2. Self-fed.
3. Fed by caregiver.
4. Spontaneous swallow versus instruction to swallow.
5. Alternating liquids and solids.

VIII. Evaluation of swallowing physiology and coordination

A. The intent of the VFSS is to identify if an individual has normal or abnormal swallowing. If abnormal swallowing is identified, the clinician determines the physiologic causes for swallowing breakdowns. The list

below has been developed to facilitate swallowing physiology interpretation; however, swallowing is a synergistic process and should be evaluated accordingly.

B. Physiology and coordination.
   1. Lip closure.
   2. Mandibular motion and mastication efficiency (i.e., range of motion and speed).
   3. Onset of lingual bolus propulsion.
   4. Tongue range of motion, and control during:
      a. Elevation of bolus to palate.
      b. Bolus seal against palate.
      c. Anterior to posterior propulsion of the bolus.
      d. Lateral tongue range of motion and control.
   5. Tongue base retraction (i.e., approximation of tongue base to pharyngeal wall).
   6. Velopharyngeal closure (i.e., adequacy and timing).
   7. Timing of pharyngeal response and bolus location relative to timing.
   8. Oral and pharyngeal transport time.
   9. Pharyngeal muscle contraction (i.e., degree and symmetry).
   10. Airway protection: supraglottic level (i.e., arytenoids to base of epiglottis approximation; epiglottic inversion).
   11. Airway protection: glottic level (i.e., vocal fold/arytenoid mobility; glottic closure—anterior-posterior [range and symmetry of movement] and lateral views).
   12. Hyolaryngeal motion (vertical and anterior, including epiglottic inversion).
   13. Upper esophageal opening (width, duration, and timing).
   14. Coordination of pharyngeal structural movement during swallow.
   15. Presence or absence of upper airway and/or aerodigestive tract obstruction (enlarged adenoids).
   16. Movement of bolus through upper 1/3 of esophagus.

C. Identify and interpret the impact of abnormal swallowing physiology.
   1. Penetration: cause, timing, and approximate percentage/severity.
   2. Aspiration: cause, timing, and approximate percentage/severity.
   3. Residue: cause, approximate percentage, and location.
   4. Sensory awareness and reaction to residue (e.g., re-swallow).
   5. Sensory awareness and reaction to penetration (e.g., cough, throat clear).
   6. Sensory awareness and reaction to aspiration (e.g., cough, throat clear).
   7. Effectiveness of reaction to residue, penetration, and/or aspiration (e.g., reduction in percent residue, effectiveness of cough, and expectoration of material from airway).

D. Therapeutic intervention trials.
   1. Once abnormal swallow anatomy/physiology has been determined, evaluate the effect of postures, maneuvers, bolus modifications, compensatory techniques, and sensory enhancement in improving swallowing safety and efficiency. (NOTE: This list is a compilation of possible intervention techniques that may be performed alone or in combination. Application of these techniques is dependent upon the age and ability of the patient).

2. Postures.
    a. Chin tuck: for premature spillage of bolus into pharynx, delayed triggering of the pharyngeal swallow, and/or reduced laryngeal vestibule closure; to protect the airway (Logemann, 1993; Logemann, Rademaker, Pauloski, & Kahrilas, 1994; Rasley et al., 1993; Shanahan, Logemann, Rademaker, Pauloski, & Kahrilas, 1993; Welch, Logemann, Rademaker, Pauloski, & Kahrilas, 1993).
    b. Head rotation: for unilateral pharyngeal weakness; to close off weaker side of pharynx (Logemann, Kahrilas, Kobara, & Vakil, 1989; Logemann, 1998; Logemann et al., 1994).
    c. Head tilt: for unilateral oral and/or pharyngeal disorder to channel bolus through stronger side of oral cavity and/or pharynx (Logemann, 1998).
    d. Head back: for impaired tongue anterior-posterior motion to facilitate bolus transfer through oral cavity (Logemann, 1998).
    e. Side-lying: for reduced pharyngeal clearance to allow residue to remain on the lateral pharyngeal wall and prevent aspiration after the swallow (Logemann, 1998).
3. Maneuvers.
    a. Supraglottic swallow: to improve glottic closure (Logemann et al., 1995; Bisch, Logemann, Rademaker, Kahrilas, & Lazarus, 1994).
    b. Super Supraglottic swallow: to improve supraglottic and glottic closure (Logemann et al., 1995; Bisch et al., 1994).
    c. Mendelsohn maneuver: to improve laryngeal vertical and anterior motion and increase width and duration of upper esophageal sphincter opening (Lazarus, Logemann, & Gibbons, 1993; Logemann & Kahrilas, 1990; Kahrilas, Logemann, Krugler, & Flanagan, 1991).
    d. Effortful swallow: to improve tongue base posterior motion (Logemann, 1993; Lazarus, Logemann, Song, Rademaker, & Kahrilas, 2002; Pouderoux & Kahrilas, 1995).
4. Bolus modifications.
    a. Volume change: to determine effects of volume on swallow physiology (Bisch et al., 1994; Lazarus et al., 1993; Logemann et al., 1995).
    b. Viscosity change: to determine effects of viscosity on swallow physiology (Bisch et al., 1994; Lazarus et al., 1993).
5. Other compensatory techniques.
    a. Double or multiple swallows: to eliminate residue.
    b. Alternate liquids and solids: to eliminate residue.
    c. Throat clearing: to eliminate residue.
6. Sensory enhancement.
    a. Flavor change (e.g., sour, sweet, spicy): to facilitate lingual motion and/or improve triggering of the pharyngeal swallow (Logemann et al., 1995).
    b. Texture change: to facilitate lingual motion (Bisch et al., 1994; Logemann et al., 1995).
    c. Temperature change: to facilitate lingual motion and/or improve triggering of the pharyngeal swallow (Bisch et al., 1994).

d. Thermal-tactile stimulation: to improve triggering of the pharyngeal swallow (Lazzara, Lazarus, & Logemann, 1986; Rosenbek, Roecker, Wood, & Robbins, 1996).

E. Evaluate factors that influence the effectiveness of intervention strategies.
1. Fatigue.
2. Patient motivation.
3. Patient alertness, judgment, and distractibility.
4. Level of cueing and assistance necessary to perform techniques.
5. Ability to repeatedly and consistently perform techniques.
6. Language and cultural influences.

F. Monitor possible adverse reactions to examination.
1. Agitation.
2. Changes in breathing pattern.
3. Changes in level of alertness.
4. Changes in color.
5. Nausea and vomiting.
6. Changes in overall medical status which may be assessed via pulse oximeter, heart rate monitor, etc.
7. Other.

IX. Interpretation and documentation

A. Review the recorded study.

B. Incorporate pertinent history.

C. Identify and document anatomic and physiologic swallow disorder(s) of oral preparatory, oral, pharyngeal, and cervical esophageal phases.

D. Determine and document impact of anatomic and physiologic swallow disorder(s) (i.e., location and approximate percentage of residue, laryngeal penetration, presence, timing, and approximate percentage of aspiration).

E. Observe and document sensory awareness of residue, penetration, and/or aspiration (i.e., cough, throat clear, second swallow).

F. Observe and document effectiveness of clearing of residue, penetration, and/or aspirated material.

G. Document effectiveness of compensatory techniques, postures, maneuvers, sensory enhancements, and bolus modifications.

H. Document individual's tolerance of and response to examination (e.g., following of directions, evidence of fatigue, signs of stress particularly related to pediatric populations, ability to repeat therapeutic interventions).

I. If applicable, describe any suspected anatomic (e.g., tracheoesophageal fistula, cricopharyngeal bar, diverticulum) and/or physiologic abnormalities of the esophagus and defer to radiologist.

J. Interpret findings in the context of the patient's overall medical, pulmonary, neurodevelopmental, and nutritional status before making recommendations.

K. Once determined, document recommendations regarding:
1. Oral versus non-oral delivery of nutrition and hydration.
2. Specific oral intake modifications (e.g., volume, viscosity, texture, nipple type, etc.).
3. Therapeutic interventions required during meals (e.g., postures, maneuvers, sensory enhancements, assistance, etc.).
4. Safe feeding/aspiration precautions (e.g., sit upright, no straws, alternate liquids and solids, etc.).
5. Positioning.

6. Diet consistent with ethnocultural preferences and practices.
7. Need for thorough and consistent oral hygiene.
8. Dysphagia rehabilitation treatment plan consistent with exam findings.
9. Need for and timing of reevaluation.
10. Necessary referrals.

L. Provide prognostic statement.
M. Document that results were discussed with appropriate medical personnel, individual with dysphagia, and caregiver.
N. Ensure that documentation is interpretive, clear, thorough, and legible.

X. Follow-up
A. Educate individual with dysphagia and family/caregiver as to findings and recommendations (may include review of recorded study when possible).
B. Educate staff (e.g., nursing, CNAs, care-planning team, teachers, aides) as to findings and recommendations.
C. Provide results of examination to referring source.
D. Assure recommendations are tolerated and followed, when possible.
E. Make recommendations for repeat follow-up as needed.

XI. Recommended fluoroscopic equipment, other equipment, and supplies
A. Fluoroscopy system.
1. Utilize a fluoroscopic system that provides a video signal at a minimum resolution of 400 lines.
2. SLP should confirm with facility radiation equipment specialist (RES) that the fluoroscopic system meets all federal and state radiation standards and is consistent with American College of Radiology standards.
3. SLP should confirm fluoroscopic system has collimators to limit radiated field to the oropharyngeal region, trachea, and esophagus.

B. Recording device.
1. The type of fluoroscopy equipment (i.e., digital vs. analog) should be considered when purchasing recording equipment. If the fluoroscopy unit is analog, an optimal analog video recording device should have four heads and record at a minimum of 400 lines (VHS/ S-VHS format). If the fluoroscopy unit is digital, digital recording devices are available and should record at 30 frames per second. Downscanners (converters) that convert D/A (digital to analog) can be purchased, which would allow the digital fluoroscopy signal/image to be recorded onto analog (VHS/S-VHS format) recording equipment. Likewise, if digital recording equipment is used with an analog fluoroscopic unit, an A/D (analog to digital) converter is needed to convert the analog fluoroscopy signal/image to a digital. In addition, a jog wheel which enables slow motion and/or frame-by-frame tape movement is helpful.

C. A character generator is useful for documenting patient name, date, medical record.
D. A time code generator is useful for measuring temporal events, structural movement, and bolus flow during the swallow.
E. Monitor.
F. Microphone.
G. Lead-shielded protective apparel (See special considerations: Radiation safety)
1. Lead apron.

2. Thyroid shield.
3. Protective glasses.
4. Protective gloves.

H. Dosimetry badges.
I. Barium of varying viscosities (See special considerations: Viscosity).
J. Testing consistencies (e.g., liquids, solids, tablets).
K. Sampling consistencies of individual food preferences or those causing complaints.
L. Suctioning equipment, external oxygen supply, personal protection equipment, medical status monitoring.
M. Positioning devices (e.g., bolsters, rolls) and seating (pediatric and adult).
N. Feeding utensils (e.g., spoons, cups, nipples).

XII. Obtaining clinical experiences and developing competencies

A. ASHA's Code of Ethics requires that individuals provide services competently. An SLP attains and maintains an appropriate level of competency per the discretion of the individual clinician, his/her supervisor, and/or facility policy and procedures. Competency is a dynamic process that requires ongoing education and experience. It is not something that is achievable through continuing education courses or reading alone, but requires a multidimensional approach, which may include the following:
   1. Observe and participate in the VFSS with an experienced clinician. The number of supervised studies required is at the discretion of the mentor/supervisor, based on the trainee's competence.
   2. Once conducting the VFSS, meet with an experienced clinician on a regular basis to review accuracy of observations and therapeutic management (e.g., identification of swallowing disorders, presence of aspiration, appropriateness of therapeutic strategies used in x-ray). Meetings will include review and discussion of written reports.
   3. Attend continuing education courses that focus on interpretation of the VFSS.
   4. Review current literature about the VFSS.
   5. Participate in study groups with other SLPs who perform the VFSS.
B. If using this suggested training guideline for a graduate level course, please also refer to the ASHA Graduate Core Curriculum on Swallowing and Swallowing Disorders (Adult and Pediatric Dysphagia) (ASHA Special Interest Division 13: Swallowing and Swallowing Disorders [Dysphagia], 1997).

Special Considerations

The information that follows has been compiled to address current issues in the field of speech-language pathology relative to conducting a VFSS. The issues discussed in the following sections are in response to frequently asked questions from professionals regarding how to appropriately proceed in conducting a safe and/or ethical VFSS. These issues are addressed relative to current standards of practice in the field of speech-language pathology.

Issue: Presence of a radiologist

Current ASHA policy does not require that a radiologist or other physician be present in the examination room during the completion of a VFSS by a competent SLP. However, relative to today's standard level of practice, most VFSSs are performed with both the speech-language pathologist and the radiologist present.

This provides an environment in which the speech-language pathologist focuses on swallowing physiology and functioning and the radiologist is able to make medical diagnoses relative to anatomy. Thus, the speech-language pathologist and radiologist typically collaborate to comprehensively assess swallowing as it relates to physiology and anatomy. In some cases, the study may be done with the SLP and radiology technologist, with the radiologist available for consultation, as needed. When a radiologist is not present during the VFSS, the SLP assesses and comments on swallowing physiology and function only. The VFSS assessment and report do not include medical diagnoses. The SLP should be aware of state legal and regulatory issues regarding the presence of a radiologist or other physician, as well as third party payer requirements.

Issue: Management and documentation: Legal and ethical considerations

The SLP should communicate VFSS results and recommendations to the managing physician and treatment team. Decisions to comply with VFSS recommendations, however, may be influenced by medical or social issues, quality of life concerns, or other cultural/personal factors that should be respected by the SLP (Sharp & Genesen, 1996). In some instances, recommendations based on VFSS findings will not be followed by any or all individuals involved in the care of a patient with dysphagia (e.g., patient, family/caregiver, involved medical staff, and/or other individuals). Consultation with the facility Ethics Committee and Risk Manager may be warranted. The SLP must counsel involved parties as to the possible negative health consequences (e.g., aspiration pneumonia, respiratory arrest, etc.) if they choose not to follow the recommendations. Documentation must include all communication with the patient and/or involved individuals (i.e., date and time of exchange, individual's response to communication, quotes) and must reflect their wishes. Documentation should also follow facility-specific risk management guidelines, as appropriate.

If recommendations concerning the method and type of nutrition are not followed and swallow therapy is not indicated, the SLP should provide any information that might result in safer swallowing. If no information is relevant or available, due to the severity of the swallowing problem, the SLP should make this clear to involved individuals. Should the SLP feel that it is inappropriate to continue swallowing management when recommendations are not followed, the SLP should maintain some degree of contact with the individual with dysphagia. This may require modifying swallow management, such as continuing swallow therapy, but not being present during meals if the recommendation was made for non-oral nutrition. The SLP also may choose to discontinue management at this point, but should avail him/herself to further communication with involved parties as appropriate.

Issue: Viscosity

Changing the bolus flow by thickening the consistency of liquids has become a standard intervention strategy in the treatment of individuals with dysphagia. Clinicians commonly refer to this practice as changing the viscosity of the liquid. Viscosity is a property of all food items, not just of liquids and is used to describe a materials' resistance to flow (Huckabee and Pelletier, 1999). Clinicians commonly recommend nectar-thick, honey-thick, or pudding-thick viscosity levels based on the results of the VFSS. Selective use of thickened liquids as a compensatory technique has been shown during the VFSS to increase swallowing efficiency (Bisch, et al., 1994; Dantas, et al., 1990; Lazarus, et al., 1993;

Logemann, 1998). This has been clinically assumed to decrease the risk of aspiration and may lead to the potential for adequate hydration in individuals that might have avoided or been restricted from thin liquids due to aspiration risks.

There are little data in the literature to support or guide this practice, yet it has become one of the most frequently used compensatory interventions in hospitals and long-term care facilities (Robbins et al., 2002). Research is underway to further define bolus flow characteristics (the science of rheology) and their interactions on the sensory and motor aspects of the swallow. Until such time that this research is available, the practicing clinician can best serve persons with dysphagia by developing recipes and mixing methods for use in their facilities that will be reliable and consistent from assessment to intervention. For example, recipes should be developed within a facility for different liquid consistencies to be used in the VFSS and efforts should be made to match consistencies to those that are available on the dietary menus. If strict mixing methods are not adhered to, there is much room for intra-subject as well as inter-subject variation in preparation (Glassburn and Deem, 1998). By uniformly using specific recipes, viscosity ranges can be maintained within a respective facility.

Objective viscosity measurement and reliability is only obtained with instrumentation. A viscometer objectively measures the thickness of a liquid; however, viscometers are not routinely available outside of the laboratory. Various ranges in centipoise have been described in the literature to represent nectar-thick, honey-thick, and pudding-thick liquids. The literature and products on the market are not universal in their centipoise ranges within each of the viscosity levels (Mills, Brown, Daubert, Casper, & Tobochnik, 1998; Pelletier, 1997). Until such research findings are available and industry standards are developed, the clinician should be vigilant of uniform liquid thickening techniques and maintaining uniformity between assessment and intervention viscosities.

Issue: Pediatrics

Feeding and swallowing skills change dramatically during the first three years of life. Developmental gains in feeding and swallowing are due to the combined influences of anatomic growth, neuromotor maturation, and learning. SLPs performing a VFSS on children should know the unique anatomic features of the pediatric aerodigestive tract (Arvedson & Brodsky, 1993; Bosma, 1985, 1986; Kent & Vorperian, 1995) and the typical developmental sequence observed for feeding and swallowing skills (Gisel, 1991; Green et al., 1997; Morris, 1989; O'Brien, Repp, Williams, & Christophersen, 1991). During the first year of life, the suck-pattern characteristic of infant feeding is rapidly replaced by oral-motor skills for intake of solids as well as liquids. These oral-motor skills continue to be refined through early childhood. SLPs working with young children should also know the clinical symptoms and etiologies that are unique to the pediatric population. Behaviors such as food refusal and selective eating may be related to long-term tube feedings, NPO status, and/or prolonged discomfort with eating secondary to surgery or gastroesophageal reflux (Arvedson, 1997; Dellert, Hyams, Treem, & Geertsma, 1993). Procedures for performing the VFSS on young children will need to be modified considerably based on the child's developmental status and ability.

As with adults, recommendations are made for videofluoroscopic assessment if clinical signs of swallowing dysfunction are observed during feeding. Etiologies frequently associated with pediatric swallowing dysfunction include cardio-respiratory compromise, neurologic impairment, and structural abnormalities.

- Cardio-respiratory compromise—Young infants may have difficulty initiating or sustaining a rhythmic, coordinated suck-swallow-breathe sequence during sequential swallowing with bottle feeding. The inability to coordinate breathing and swallowing may be secondary to underlying respiratory compromise such as bronchopulmonary dysplasia associated with prematurity, cardiac conditions, and tachypnea (e.g., respiratory rate > 60 breaths per minute; Wolf & Glass, 1992).
- Neurologic impairment—Congenital or acquired neurological conditions may affect the oral and pharyngeal phases of swallowing and maintenance of airway protection.
- Structural abnormalities—Structural impairments of the oral cavity, pharynx, or larynx have the potential to cause or contribute to feeding/swallowing dysfunction. Such anomalies may include, but are not limited to: cleft lip and palate, choanal atresia, micrognathia, macroglossia, pharyngeal stenosis, laryngeal cleft, tracheosophageal fistula, and vascular anomalies causing compression in the esophagus and/or airway.

Secondary behavioral signs/symptoms in infants and children should also be identified. Sensory issues affecting feeding should be identified, if applicable.

Considerations for Pediatric Examination Protocol

The examination protocol for infants and young children should be appropriate for the child's size and developmental status. Radiation exposure time needs to be minimized in the pediatric population. Radiation safety documents list lower exposure rates and allowable dose limits for infants and children (Brent, 1989; NCRP, 1977). Young children are typically not capable of communicating their difficulties with swallowing, therefore the SLP should continuously monitor for clinical symptoms and signs of possible airway compromise during the examination. Examples include:

- Gagging, coughing, crying, choking, or vomiting during or following oral feeding.
- Back arching.
- Clinical signs of difficulty with swallowing initiation.
- Noisy or wet vocal quality noted during/after feeding; increased congestion.
- Difficulty with coordination of a rhythmic suckswallow sequence with breathing during nipple feeding.
- Liquid/food evident in tracheotomy; evidence of food/liquid upon suctioning.
- Oxygen desaturation with feeding.
- Bradycardia or tachycardia in association with feeding.
- Decrease in responsiveness during feeding.

The swallowing protocol should include consistencies that are developmentally appropriate. For infants, continuous suck-swallow-breathe sequences during bottle/nipple feeding should be evaluated. The study should include initial sucking burst cycles as well as intermediate cycles to assess for fatigue (Newman, Keckley,

Petersen, & Hamner, 2001). For children who are developmentally ready for semi-solid and solid consistencies, multiple spoon feeding and solid intake trials should be observed.

Equipment for positioning will vary depending on the size of the child and medical condition (Arvedson & Lefton-Greif, 1998; Gisel, Applegate-Ferrante, Benson, & Bosma, 1996). Infants under six months of age typically require head, neck, and trunk support. If possible, observe each child's feeding and swallowing in the typical feeding position. When appropriate, the VFSS protocol should examine the effectiveness of the following modifications:

- Positional changes for bottle/nipple feeding and spoon feeding.
- Modifying the rate of bolus delivery (e.g., changing nipple flow rate, altering fluid viscosity).
- Alternating liquids with solids to improve clearance through hypopharynx and esophagus.

Issue: Pharyngoesophageal considerations

The standard VFSS typically views bolus flow from the oral cavity to the cervical esophagus. However, in the course of this “standard” examination, SLPs may encounter patients whose reported symptoms reflect esophageal difficulties. While it is the responsibility of appropriately trained physicians to evaluate and diagnose esophageal stage dysphagia, the SLP must possess the ability to recognize characteristic patient complaints and obtain a clinical history, which assists in identifying primary or related esophageal phase problems. The role of the SLP includes identifying disorders of the upper aerodigestive tract relative to swallowing, which includes “oral, pharyngeal, and cervical esophageal anatomic regions” (ASHA, 2002a). Clinicians should be aware that oropharyngeal swallowing function is often altered in patients with esophageal motility disorders and dysphagia.

The speech-language pathologist should have the knowledge and skills to recognize patient signs and symptoms that may be associated with cervical-esophageal and esophageal phase dysphagia. Such signs and symptoms may include (but are not limited to):

- Complaint of food “sticking” during swallowing (persistent or intermittent).
- Specific complaints of difficulty swallowing solid food.
- Sensation of discomfort or food sticking anywhere from mid-chest to neck region.
- Report of coughing up food/pills after the swallow.
- Requiring liquids to complete a meal.
- Complaints of dysphagia without overt signs of swallowing difficulty.
- Report of odynophagia (base of throat/chest/sub-sternal).
- Complaints of obvious symptoms of heartburn.
- Report of related symptoms of potential laryngopharyngeal reflux, esophageal reflux (e.g., nighttime halitosis, voice change, chronic respiratory, or sinus problems).
- Report of regurgitation.
- Report of unexplained weight loss, altered hunger, and appetite.

The SLP should probe to understand the variation, progression, and frequency of symptoms. Based on patient reports, medical history, and clinical examination, the SLP should recognize the need for an extended VFSS with an esophageal

screening, or a separate esophagram and/or upper gastrointestinal series scheduled either in conjunction with the VFSS, or performed at a later time. An esophageal screening can be incorporated into most VFSSs if the patient can tolerate even a small amount of p.o. contrast. The decision to perform these additional assessments is made with the radiologist, and/or after consultation with the referring physician (Mendell & Logemann, 2002).

Usually accomplished in the lateral view, this limited addition to the examination typically tracks a semi-solid or liquid bolus through the esophagus and into the stomach. If the patient is seated in a special chair, raising the chair to the highest position normally allows for a full sweep through the esophagus and lower esophageal sphincter screening for bolus flow through the esophagus. Typically, the SLP may encounter the following esophageal dysfunction:

- Esophageal dysmotility.
- Cricopharyngeal bars/strictures.
- Esophageal narrowing.
- Esophageal strictures/webs.
- Zenker's or other type diverticulum.
- Gastroesophageal reflux, or laryngopharyngeal reflux.
- Hiatal hernia.
- Mucosal abnormalities.
- Achalasia.

This screen, done in conjunction with radiology, may identify gross abnormalities but should not be considered a full esophagram. Esophagrams (either single or double contrast) and upper gastrointestinal (UGI) series incorporate large bolus swallows using liquids of varying densities to distend the esophagus and identify mucosal abnormalities and subtle lesions/strictures. Many severely dysphagic patients can simply not tolerate esophagrams, which typically study the patient in side lying (right anterior-oblique) or erect position. These examinations are more appropriate for the ambulatory patient who is being seen to assess a complaint of dysphagia with unclear etiology. Protocols vary widely from facility to facility. Based on the findings of the VFSS, the SLP should confer and collaborate with the radiologist to make appropriate referrals. An upper GI series, esophageal manometry, endoscopy, and/or pH studies, may be required to evaluate gastroesophageal function.

A basic understanding of oropharyngeal and esophageal swallowing relationships will allow the clinician to provide optimal services, thus reducing the risk that underlying causes of a patient's dysphagia will go undetected during an examination. The SLP plays a primary role in addressing all aspects of the patient's dysphagia. As with any aspect of dysphagia management, the team approach is vital.

Issue: Radiation safety for the SLP

The medical SLP is typically required to plan, implement, and interpret videofluoroscopic studies on a frequent basis, however many clinicians do not have an understanding of the basic scientific principles and facts about ionizing radiation as they relate to radiation safety. Knowledge of radiation safety should be based on a basic understanding of ionizing radiation and its use in diagnostic medicine. The intent of this section is to provide key information an SLP should have before

being involved with this procedure. It is highly recommended that SLPs receive formal instruction regarding x-rays and radiation issues. Specific protocols and questions should be directed to the facility radiation safety officer (RSO).

Definition and description: Videofluoroscopy is recorded dynamic radiography that utilizes continuous x-rays to assess swallowing function. Chemicals stored in the fluorescent screen become illuminated when they are exposed to x-rays. For the assessment of swallowing function, videofluoroscopy has three primary advantages over film-based radiographic methods: (1) it does not require photographic processing, (2) it provides real-time images of bolus transport and oropharyngeal motility, and (3) it provides a means for off-line assessment of the patient's swallowing status during or after the study.

Following are guidelines based on the basic scientific principles and facts needed to fully appreciate the rationale for radiation safety precautions. This information has been compiled from numerous sources including: Beck & Gayler, 1990; Bushong, 1997; Dowd, 1994; National Council on Radiation Protection and Measurements, 1971, 1989, 1990, 1994; Ohio Department of Health: Bureau of Radiation Protection; Wagner & Archer, 2000; and Wright, Boyd, & Workman, 1998.

The SLP should:

A. Know the basic scientific principles and facts that apply to the use of ionizing radiation during fluoroscopy.
    1. X-rays are a form of radiant energy that enter matter (e.g., human tissue). Some x-rays will be absorbed by and interact with matter partially or completely, while others will pass through without interaction. When x-rays enter the body, denser tissues (such as teeth and bone) absorb more x-rays than softer tissue (such as muscles and digestive organs).
    2. The majority of the radiation dose received by the SLP or other study participants (provided the primary beam is avoided) comes from *scattered* radiation. The source of scattered radiation is the patient. Scatter is x-rays that interact with matter and change direction. As the x-ray beam interacts with the tissue of the patient, radiation is scattered more or less uniformly in all directions. These x-rays may lose some of their energy, but can still interact and be absorbed by other tissue.
    3. X-rays cannot be “focused” but require collimation (restriction of x-ray beams) and filtration (removal of low energy x-rays) to narrow the field of exposure. Tightly collimating the x-ray beam to the area of interest reduces the amount of scatter and the volume of tissue exposed, and improves the quality of the image.
    4. Exposure to x-rays can have negative biological effects.

B. Know the basis of biological effects associated with ionizing radiation on the adult, child, fetus, and embryo.
    1. Ionization, a reaction in which radiation interacts with matter, is a random process and difficult to predict. Radiation can interact with cellular atoms creating “free radicals.” These are uncharged molecules that are highly reactive, short lived, and contain excess energy that can disrupt other molecules. DNA and RNA are key molecules and key targets for radiation. This is the basis for biological effects in humans.

2. Tissue of the human body has variable sensitivity to radiation. Highly sensitive tissues are organs that rely on large amounts of cell reproduction (e.g., bone marrow, GI tract, skin, testes-reproductive organs). Intermediate sensitivity tissue includes tissue with slower cellular reproduction (e.g., cornea, liver). Lower sensitivity tissues include muscles, brain, and spinal cord. Younger, rapidly developing tissue (e.g., an embryo) is more sensitive to the effects of radiation than older tissue.
3. Background radiation comes from naturally occurring radionuclides in soil and rock and the food we eat. It also comes from cosmic rays and indoor radon. Therefore, no zero dose levels of radiation exist as radiation is all around.
4. There are no "radiounique" effects. That is, those biological effects that occur secondary to radiation can also occur for other reasons (e.g., cataract formation).

C. Know the classifications of biological effects (Beck & Gayler, 1990; Bushong, 1997; Dowd, 1994).
1. Stochastic: A randomly occurring, all or none effect where the probability of occurrence, but not the severity increases with dose exposure (e.g., cancer, gene mutation).
2. Non-stochastic: A dose threshold must be reached for a biological effect to occur (e.g., skin damage, cataract formation, hair loss)
3. Early effects: Those that occur within a few hours, days, or weeks after an acute exposure (e.g., large dose within a short time).
4. Late effects: Those that occur at least 5 years after exposure. The principal late effects are cancer and/or cataract formation.

D. Know the cardinal radiation safety factors of time, distance, and shielding.
1. Time: Duration of study should be reduced whenever possible.
   a. Halving time halves personal exposure.
   b. Fluoroscopy time typically should not exceed five minutes if possible.
   c. Rotate assignments between staff members if possible.
2. Distance: SLP should remain as far from the patient and x-ray tube as practical.
   a. Increasing distance is one of the most effective means of reducing exposure.
   b. The amount of radiation exposure one receives is inversely related to the distance one is from the source (inverse square law).
   c. Shielding: SLP should wear protective apparel during study.
   d. Appropriate shielding such as lead aprons, eye shields, thyroid shields, and lead gloves decrease radiation exposure to vulnerable body organs.
   e. The amount of exposure decreased by shielding will vary with the energy of the x-ray and the thickness of the shield.

E. Know and practice the fundamentals of dosimetry in the monitoring of radiation exposure.
1. SLP will wear a film badge (dosimetry badge) on the outside of the lead apron at the neck area that will be reviewed periodically by the RSO. A second badge to be worn under the apron may be required by some facilities.

2. Facilities may require additional badges to be worn on various locations of the body.
3. SLPs who are at risk for repeated radiation exposure to the hand (due to feeding patients) may wear a ring dosimetry badge which will be reviewed periodically by the RSO.
4. SLP will not receive more than 5000 mrem/year (5 rem) (NCRP, 1971)
5. Pregnant SLPs—see section F.

F. Know special considerations and safety precautions given to pregnant radiation patients and workers (Bushong, 1997; NCRP, 1994).
1. Follow facility radiation safety guidelines for management of individuals in their reproductive years (e.g., provide a lead apron to cover reproductive organs).
2. If the SLP participating in the VFSS is pregnant, the pregnancy must be declared and the facility RSO contacted for personal radiation safety management issues (e.g., dose rates, extra protection, exclusion from conducting studies, any previous exposure history).
3. Pregnant SLPs should wear a lead wraparound apron of the highest lead content.
4. Pregnant SLPs may require more frequent dosimetry badge review. An additional dosimetry badge is worn at the waist below the apron.
5. Embryonic/fetal exposure should not exceed 50 mrem (.5 rem) for the duration of the pregnancy. During the first trimester the embryo is the most vulnerable to the potential biological effects of radiation. Normal protective measures typically keep the embryo/fetus of a pregnant worker well below dose limit (DL) recommendations.

G. Know the roles and responsibilities of the medical facility, radiologist, radiology technologist, and facility radiation safety officer in conducting safe, effective VFSSs for patients (adults and pediatrics) and workers.
1. SLP will identify the Radiation Safety Officer (RSO) in facility.
2. SLP should be able to identify the appropriate personnel who can confirm that the fluoroscopic system meets all federal and state radiation standards.
3. SLP and/or radiologist should assure fluoroscopic system has collimators to limit radiated field to the oropharyngeal region, trachea, and esophagus.

H. Know the local agencies/organizations that have regulatory authority concerning ionizing radiation, and the current NCRP and local agencies recommended dose limits for radiation for workers and the general public (NCRP, 1990).
1. Nuclear Regulatory Commission (NRC).
2. State Department of Health-Bureau of Radiation Protection.
3. National Council on Radiation Protection (NCRP).
4. American College of Radiology (ACR).

I. Apply knowledge of radiation safety through appropriate selection and referral recommendations for individuals to undergo videofluoroscopic procedures. Clinicians should be cognizant of radiation exposure to individuals receiving VFSS relative to timing and frequency of follow-up studies.

J. Apply knowledge of radiation safety through implementation of well-planned, efficient VFSSs that keep radiation exposure As Low as Reasonably Achievable (ALARA) while conducting a thorough exam.
1. Practice therapeutic maneuvers, as possible, before fluoroscopy is used.

2. Position the patient via the guiding beam light before fluoroscopy is engaged.
3. SLP will use appropriate barium (contrast) viscosity ranges for swallowing.

K. Participate in annual radiation safety programs and radiation exposure monitoring offered by your medical facility and mandated by your State Department of Health-Bureau of Radiation Protection.

Issue: Medications

It is essential that the clinician include medications and medication schedules in the history taking for the individual with dysphagia. Medications may enhance an individual's swallowing ability or interfere with both the oropharyngeal swallow and an individual's appetite and may influence the individual's performance during the VFSS. Many commonly used drugs have an effect on the swallow (Alvi, 1999; Campbell-Taylor, 2001). Also, “polypharmacy” is generally the norm with the elderly, especially the elderly patient in an acute or extended care setting. In many nursing homes/long-term rehabilitation settings, individuals receive so many medications that they require a special care plan informing all team members of possible drug interactions and side effects.

An adverse drug reaction is considered anything beyond the expected therapeutic effects. Medications may affect central nervous system functioning and produce both oropharyngeal dysphagia and dysarthria. Impaired cognition and attention span can occur simultaneously or secondary to other medications. Gastroesophageal reflux severe enough to impact oral intake, dry mouth, and altered taste are just a few other common complications of drugs given routinely to individuals with whom the speech-language pathologist works, typically the elderly, the very young, or the neurologically impaired. As usual, these groups are also at increased risk of adverse drug events because they do not metabolize these medications in the same manner as healthy individuals. For example, age-related decline in renal function can affect the excretion of a drug from the body.

Any change in swallowing should also be explored as possibly relating to a medication issue. As medications change, a repeat VFSS may be necessary to assess any potential effects on swallowing physiology.

Glossary

Absorbed dose: energy imparted by ionizing radiation per unit mass of radiated material. Units of absorbed dose are the Gray and Rad.

ALARA (As Low as Reasonably Achievable): an acronym used for radiation protection. The principle of ALARA is to minimize exposure to patients and radiation workers, taking economics and social factors into account (NCRP, 1990).

Background radiation: radiation in the environment from naturally occurring materials and cosmic sources.

Centipoise: a unit of measurement of viscosity.

Collimators: x-ray blocking devices.

Declared pregnant woman: a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception. This stays in place until the pregnant woman withdraws the declaration or is no longer pregnant.

Dose equivalent: the product of the absorbed dose in tissue, quality factor and all other necessary modifying factors at the location of interest. This dose accounts for exposure to other forms of ionizing radiation not having to do with fluoroscopy. The units are Sievert and rem. Dose equivalent limit (annual) is the annual dose equivalent limit defined by the degree to which radiation exposure should be controlled to achieve an acceptable level of risk for workers and the general public, taking into account both somatic and genetic effects of ionizing radiation exposure.

Dosimeter: an instrument that responds to the presence of radiation, and measures the dose or amount of exposure. Dosimetry badges incorporate a film that absorbs radiation which can later be measured for occupational exposure.

Exposure: Exposure to sources of ionizing radiation.

Fluoroscopy: dynamic radiography that utilizes continuous x-rays to observe motion. Chemicals stored in a fluorescent screen become illuminated when they are exposed to the x-rays, providing a real time image.

Gray (Gy): the SI (system international) unit of absorbed dose. One gray is equal to 100 Rads.

Maneuvers: voluntary controls exerted over selected aspects of the oropharyngeal swallow (Logemann, 1998).

Odynophagia: painful swallow.

Polypharmacy: the use of a number of different drugs by a patient who may have one or several health problems.

Rad (radiation absorbed dose): special unit of radiation absorbed dose. One rad is equal to .01 gray.

Rem (radiation equivalent man): a unit of measure of radiation, which expresses the energy deposited per unit mass multiplied by a quality factor to account for the type of radiation. One rem is equal to .01 Sv.

Sievert (Sv): the SI unit of any of the quantities of expressed as dose equivalent. One Sv is equal to 100 rems.

Viscosity: a material property of liquids that describes the materials resistance to flow.

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