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Clinical Focus

Assessment Across the Life Span: The Clinical Swallow Evaluation

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Purpose: This clinical focus article considers the roles of the clinical swallow examination (CSE) as a clinically meaningful assessment method used in both adult and pediatric populations.
Method: This clinical focus article explores the utility of the CSE across the life span. Specifically, components, reliability, standardized assessments, and limitations of the CSE within the adult and pediatric populations are highlighted.
Conclusions: The CSE remains a crucial assessment tool for the speech-language pathologist. The experienced clinician can make important judgments regarding patient safety and function. If the CSE is conducted mindfully and methodically, findings can help chart the course of care for individuals needing additional assessment and possibly intervention.

Dysphagia, or swallowing impairment, can occur across the life span, leading to a number of adverse consequences, including dehydration, undernutrition/malnutrition, aspiration pneumonia or other adverse cardiorespiratory events, and poor growth, and can result in negative impacts on quality of life (see Table 1). Individuals of any age with suspected feeding and swallowing disorders are typically referred for a clinical (bedside) swallow examination (CSE)—a noninvasive method employed to assess oral skills to infer pharyngeal swallowing function. Speech-language pathologists (SLPs) often use the CSE to identify risk factors for dysphagia/aspiration and develop a profile of strengths and limitations. A CSE is often, but not always, preliminary to an instrumental (imaging) examination of swallowing using endoscopic or videofluoroscopic assessment methods. Advantages of the CSE compared to an instrumental assessment include readily available, relatively inexpensive, and easily repeatable. A CSE is "not" equivalent to a dysphagia/aspiration screen. A screening tool attempts to predict likelihood of disorder present, and the outcome is a pass/fail result. The CSE is "not" a pass/fail test. Information gained through the CSE can be used to guide hypotheses related to the physiological nature of the swallowing impairment(s) that may be verified though instrumental assessment.

A comprehensive CSE assists the clinician in potentially determining (a) immediate safety and efficiency for oral intake, as well as possible restrictions, strategies, assistance/supervision, and so forth, that may be needed; (b) if an instrumental assessment is warranted, patient's readiness for such assessment and selection of the instrumental assessment; and (c) if further referrals are needed (e.g., gastroenterology, neurology, pulmonary, craniofacial, nutrition; Langmore & Logemann, 1991). Clinicians can use CSE results to provide counseling, education, and training to the patient and caregivers concerning typical swallow function, risk factors for and signs/symptoms of dysphagia, as well as strategies to promote safe and efficient swallowing function.

Because the CSE is noninvasive, it can be administered across a variety of settings, including acute care, inpatient rehabilitation, outpatient, and nursing facilities. Standing orders may be provided on certain patient populations (e.g., stroke), or a physician may write a swallowing

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Table 1. Possible sequelae of dysphagia.

Impaired swallowing and airway protection	• Cough, gag (reflexes to assist airway protection) • Choking (upper airway obstruction) • Aspiration (bolus enters below level of vocal folds), pneumonitis (lung irritation), pneumonia (lung infection), atelectasis (partial lung collapse)
Other adverse cardiorespiratory events that may occur due to impaired swallowing/ airway protection	• Interruptions to cardiopulmonary function during oral intake (e.g., apnea, bradycardia, oxygen desaturation) • Increased work of breathing during oral intake (e.g., tachypnea, wide rib excursions, head bobbing) • Increased supplemental oxygen requirement, which may include need for positive airway pressure support (e.g., high flow nasal cannula, continuous positive airway pressure)
Inefficient and/or insufficient oral intake	• Dehydration, undernutrition/malnutrition • Prolonged mealtime duration • Weight loss, growth faltering

evaluation order based on patient complaints or observed difficulty by other health care professionals/staff members. In the United States, SLP professionals frequently respond to the order request and complete the CSE because of their specialized training as part of their graduate education and clinical experiences. Other professionals may be included, however, depending on the individual needs of the patient. For example, a physical therapist may assist with positioning of the patient to promote safe and efficient eating and drinking.

Patients deemed good candidates for a CSE include those at increased risk of dysphagia, including etiologies that impact the anatomic or physiological aspects of the head and neck (e.g., stroke, head and neck cancer, Pierre Robin sequence, laryngomalacia) or those that fail a swallow screen (e.g., Yale Swallow Protocol; Suiter et al., 2014). The patient must also be awake and alert, as well as demonstrate cognitive skills to participate.

Once a CSE has been completed, the clinician must decide how to proceed (see Figure 1). It is not uncommon for individuals to appear straightforward initially based on clinical history and initial presentation only to have the CSE reveal multiple complex factors requiring attention as patient care proceeds. Decision making in preparation for the CSE and how to proceed after should consider multiple factors, such as medical diagnoses and stage/progression of disease; underlying impairment and severity of dysphagia; prognosis, with consideration of best and worst case scenarios; patient/caregiver preferences and goals, with consideration of advanced directives, cultural influences, and so forth; available resources (e.g., insurance, access to instrumental assessment, and time to instrumental completion); and others.

This clinical focus article has been organized to address crucial aspects clinicians should consider and utilize when implementing the CSE—whether the clinician is serving only adults, only pediatrics, or serving individuals across the entire life span. While each section was intentionally written for all clinicians (no matter which end of the life span they serve), there are additional considerations provided at the end of this clinical focus article specifically for clinicians serving pediatric populations.

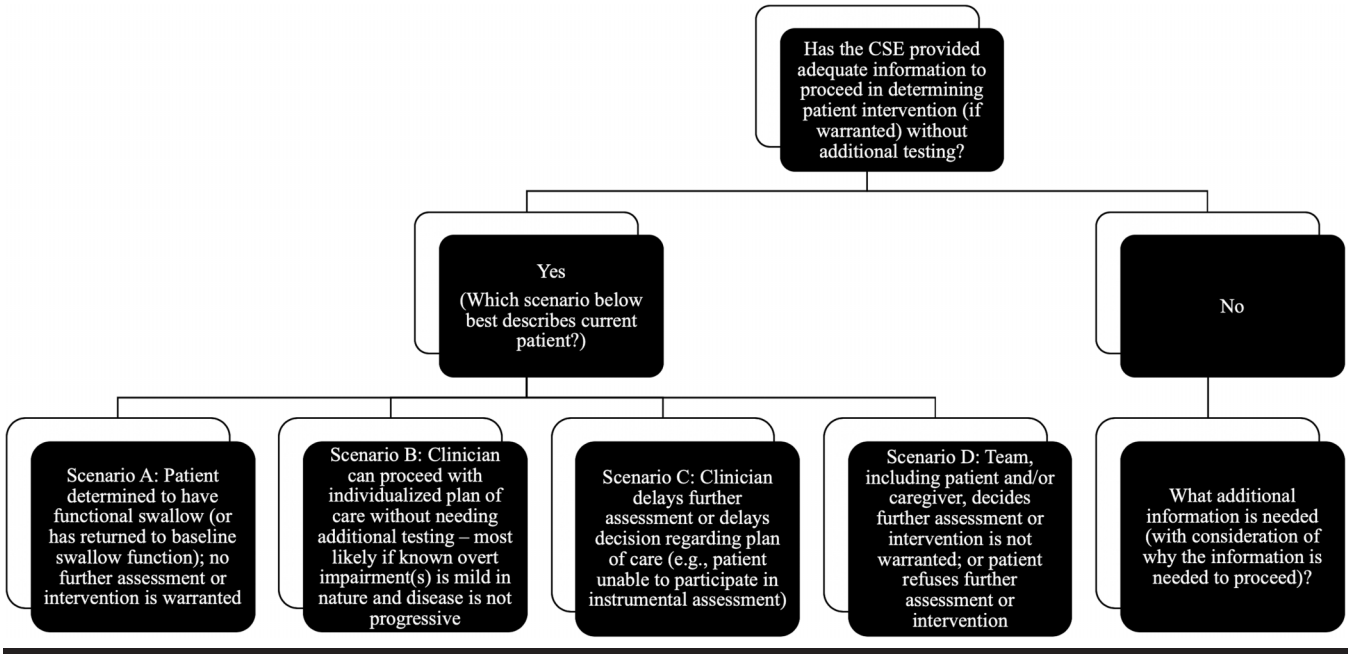
The International Classification of Functioning, Disability and Health's Framework Applied to Dysphagia Assessment

The World Health Organization's (WHO) International Classification of Functioning, Disability and Health (ICF) is critical when considering a clinical approach to dysphagia assessment (WHO, 2001). The ICF provides a framework to address functioning and disability related to a health condition within the context of the individual's activities and participation in everyday life. It goes beyond a purely medical or biological conceptualization of dysfunction and takes into account other critical aspects of disability, including the impact of the environment and other contextual factors on functioning (WHO, 2001). The ICF focuses on the impact of conditions and enables comparisons across all conditions by using a common metric—the impact on functioning for each person. For many individuals with feeding and swallowing disorders, the impact on functioning also extends to caregivers. Clinicians can use the ICF framework for measuring health and disability at both individual and population levels for individuals with feeding and swallowing disorders to consider overall health and psychosocial well-being to promote growth and development, as well as to enhance quality of life (see Table 2; Arvedson et al., 2020). The 2007 expansion to add a Children and Youth Version (ICF-CY) further allowed consideration of concepts relevant to the pediatric population.

Three primary constructs of the ICF model include (a) body structure and function, (b) activity and participation, and (c) personal and environmental factors (WHO, 2001). The body structures and functions describe the parts (structures) needed to carry out the physical act of feeding and swallowing (ingestion of a bolus into the oral cavity and into the stomach), as well as behaviors that may influence the safety and efficiency of feeding and swallowing (Threats, 2007). The clinician can further describe any atypical structure or function that contributes to feeding or swallowing impairment and identify how these impairments contribute to risk associated with dysphagia, including poor nutrition, pulmonary complications, or unintentional

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Figure 1. Example of a clinical decision-making model after completion of clinical swallow examination (CSE).



weight loss. Activities and participation relates to the intake of foods and liquids, including preparation (e.g., cutting food into smaller pieces, opening a bottle) and mode of delivery (e.g., feeding from the breast, drinking through a straw; Threats, 2007). Activities and participation could also include the patient's psychosocial status and willingness to "come to the table." This is an important part of overall life participation that can have long-term implications to mental and physical health. During the CSE, the clinician can consider how the individual performs in natural life (gained through patient/caregiver report), current functioning during CSE, and how swallowing performance changes with assistance. The clinician should consider adaptations/strategies that best promote inclusiveness and independence for self-feeding across all settings (e.g., school, work, restaurants). Lastly, the clinician should evaluate environmental factors (both facilitators and barriers) and personal factors that contribute to individual preferences to foods and liquids, as well as eating styles (Threats, 2007). A thorough CSE will encompass assessment across each ICF construct.

Components of the Clinical Swallow Evaluation

The suggested components of a comprehensive CSE are provided in Table 3 and include quantitative and qualitative data/outcomes. These components may vary depending on patient abilities and time constraints. Though not all components of the CSE must be completed, full

Table 2. Using the International Classification of Functioning, Disability and Health model (WHO, 2001) to describe constructs and considerations for individuals with feeding and swallowing disorders across the life span.

Constructs	Considerations for swallowing and feeding disorders
Body structures and functions	*Structures:* Oral, pharyngeal, laryngeal, and upper esophageal structures; pulmonary system; and gastrointestinal tract
	Functions: Sensorimotor integrity of cranial nerve function for those structures crucial to feeding and swallowing (smell, vision, taste, salivation, preparation and mastication, sucking, biting swallowing, etc.), positioning, and cognitive/communication factors influencing eating and drinking behaviors (e.g., arousal, insight, impulsivity)
Activity and participation	*Preparation:* use of utensils, opening bottles/cans, pouring liquids, mixing foods, etc.
	Bolus administration: feeding from breast, drinking from bottle/cup/straw, syringe, etc.
	Use of adaptations/modifications: head/body positioning alterations, special utensils, modified textures, etc.
Environmental and personal factors	*Environmental factors:* caregiver understanding of the feeding and swallowing disorder; access to and willingness to prepare appropriate foods and liquids, access to and willingness to use adaptive equipment such as utensils or seating, etc.
	Personal factors: age, race, other comorbidities present, personality traits (e.g., coping style; motivation), etc.

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Table 3. Components of a comprehensive clinical swallow examination.

CSE component	Purpose	Clinical relevance
Chart review	• Gather relevant information pertaining to current medical status • Gather relevant information on development (pediatrics)	• Determine risk for dysphagia/aspiration (Castell, 1996; Spieker, 2000) • Determine appropriateness for patient evaluation of swallowing function
General observations	• Gather relevant information pertaining to current patient status related to posturing and respiratory function	• Close relationship between respiration and swallowing • Determine changes in respiratory function (measure of "tolerance") • Can document changes in status during feeding
Patient/caregiver interview	• If appropriate, gather additional information regarding current swallowing function (and compare with previous function) • Gather information related to patient preferences	• Determine risk for dysphagia/aspiration (Castell, 1996; Spieker, 2000) • Determine appropriateness for patient evaluation of swallowing function
Oral care (if needed)	• Maintain good oral health	• Patient comfort • Reduce risk of pulmonary complications resulting from aspirated material (Azarpazhooh & Leake, 2006; Fernández & Clavé, 2013; Huang et al., 2017; Koichiro, 2011; Langmore et al., 1998; Müller, 2015; Pace & McCullough, 2010; Sarin et al., 2008; Yoneyama et al., 2002)
Cranial nerve (oral mechanism) examination	• Determine integrity of innervation to head and neck musculature • Determine level of neurological dysfunction	• Predict impact of dysfunction on swallowing function • Evidence suggests certain clinical signs are highly predictive of dysphagia/aspiration in adults (Daniels et al., 1998; Hiraoka et al., 2017; Horner et al., 1991; Koch et al., 2017)
Cough assessment	• Measure of airway defense	• May help determine if patient has adequate cough to clear aspirated material • Association between cough effort/cough threshold and airway invasion (Watts et al., 2016)
Motor speech examination	• Characterize speech features and establish diagnosis if abnormal • Determine level of neurological dysfunction	• Evidence suggests likelihood of co-occurring motor speech disorder and dysphagia in adults (da Costa Franceschini & Mourão, 2015; Flowers et al., 2013; Horner et al., 1991; Knuijt et al., 2014; Morgan et al., 2009)
Cognitive–communication/ language screen	• Determine presence and severity of impairment	• Disorientation associated with increased risk of aspiration (Leder et al., 2009) • Impairments in cognitive/language function can influence dysphagia management
Symptom report/quality of life questionnaire	• Determine presence and impact of swallowing impairment on daily functioning	• Can be used to document change of swallow function and effectiveness of dysphagia intervention
Bolus trials	• Observe signs or patient-reported symptoms suggesting possible dysphagia/aspiration • Trial strategies to assess influence on swallowing safety and efficiency • Determine appropriateness for oral intake and assist in recommending safest consistencies for oral diet	• Patients are 10 times more likely to aspirate on videofluoroscopy if aspiration was suspected during CSE (McCullough et al., 2005) • Can further assess strategies trialed during CSE during an instrumental exam • Association between diet recommendations from CSE and instrumental exam findings (Rangarathnam & McCullough, 2016)

Note. CSE = clinical swallow examination.

completion will provide the most comprehensive and detailed picture of the patient's current oral skills and swallowing function, as well as identification of risk factors for dysphagia-related complications so the clinician can make an appropriate treatment plan along with patient and caregivers. The authors acknowledge alterations to the CSE components described here would be required to effectively cover a CSE for younger infants.

All consults should begin with a thorough chart review (see Table 4). The role of the SLP is to sort through this vast amount of information and determine clues to help answer questions related to determining if the patient is at risk for dysphagia/aspiration, the potential underlying cause(s), and whether the swallowing difficulty resulted from the medical illness or contributed to it. A chart review also serves to ascertain whether a swallowing impairment may be developmental, acute, chronic, or worsening problem for the patient. Information gathered through the chart review should include admitting diagnosis/chief complaint; other relevant medical diagnoses; relevant surgical history; developmental history (pediatrics); relevant imaging; medications, with particular attention to those that can depress

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Table 4. Relevant information gathered during chart review and examples.

Content	Example(s)
Admitting diagnosis/chief complaint	Stroke, undernutrition/malnutrition, pulmonary embolism
Comorbidities (other relevant medical diagnoses)	Down syndrome, emphysema, insulin-dependent diabetes
Previous surgical history	Thyroid removal, cleft palate repair
Gestational and birth history, developmental history (pediatrics)	Weight at birth, complications at birth (e.g., prematurity), social/communication, and motor milestones achieved (and when)
Imaging	Chest X-ray, head/neck magnetic resonance imaging , endoscopy
Medications	Medications that may depress the nervous system or cause side effects impacting speech/swallowing function, such as tardive dyskinesia or dry mouth
Lab values	Albumin, international normalized ration, white blood cell, oxygen saturation, sodium
Health care professional notes	Speech-language pathologist, neurologist, dietitian/nutritionist, nursing

Note. List is nonexhaustive.

the nervous system or have side effects causing tardive dyskinesia or swallowing-related deficits, such as dry mouth; relevant lab values (e.g., markers of nutrition, hydration, infection, blood clotting abilities); baseline function compared to current function (nutritional status, oral intake status, swallowing ability, cognitive–communication ability); and relevant health care professional notes.

The patient/caregiver interview is another component of the CSE for providing additional information related to a patient's past and current swallowing function. Targeted questions can be used to verify information obtained during the chart review and to reveal additional details not available in the medical record. Caregiver involvement (with permission from the patient if able to provide) can be particularly useful if a patient has reduced insights into functioning. A word of caution on how questioning is structured—asking the patient what they eat and drink for each meal and/snack in 1 day can provide more detailed insights into consistencies tolerated and amount consumed than simply asking the patient if they have a swallowing problem.

The sensorimotor integrity of cranial nerve innervation to head and neck musculature crucial for speech and swallowing should be assessed for every patient. At a minimum, assessment of cranial nerves V (trigeminal), VII (facial), IX (glossopharyngeal), X (vagus), XI (spinal accessory), and XII (hypoglossal) should be completed, in addition to cervical spinal nerve 1 (which innervates the geniohyoid muscle). Documentation of strength (albeit, often subjectively rated), speed, range of motion, and symmetry should be reported. Additional cranial nerves may be tested, depending upon the patient's needs or complaints. Assessment of cough function (voluntary and/or reflexive) is an integral part of the CSE given its role in protecting the airway (Watts et al., 2016), although a strong cough may not effectively clear aspiration material out of the airway, particularly in infants and young children. It is beyond the scope of this clinical focus article to describe the assessment of cranial nerves or cough function. Resources are available to the interested reader (e.g., Fontana & Widdicombe, 2007; Garand, 2017; Watts et al., 2016).

Examination of motor speech, cognitive–communication, and language function should also be included during the CSE. Information gained from the interview can be useful as an informal measure of motor speech, cognitive–communication, and language function, or a clinician may proceed with a screening measure or standardized test as part of the CSE procedures. Cognitive and language functioning can influence the clinician's approach for dysphagia treatment. For example, poor verbal expression and/or cognitive functioning reduces reliability of reported symptoms, and poor memory may impede use of applying compensatory strategies. Results from a screening measure or standardized test can be used to determine if further assessment or referral (e.g., neuropsychology) is warranted.

Questionnaires related to signs/symptoms of swallowing difficulty and impact on quality of life may also be measured objectively using standardized and validated tools. Questionnaires validated in the adult populations include the Swallowing Quality of Life Questionnaire (McHorney et al., 2002), the Dysphagia Handicap Index (Silbergleit et al., 2012), the Sydney Swallow Questionnaire (Dwivedi et al., 2010), or the Eating Assessment Tool-10 (Belafsky et al., 2008). Disease-specific questionnaires may also be available, for example, M. D. Anderson Dysphagia Inventory for use with head and neck cancer patients (Chen et al., 2001) or the Dysphagia in Multiple Sclerosis tool (Bergamaschi et al., 2008) for use with patients with multiple sclerosis. Questionnaires can be used to document benefits of dysphagia intervention over time or may be used to identify patients in need of further assessment. Optimizing quality of life is a necessary goal for all patients with feeding and swallowing difficulties.

Another important component of the CSE—especially prior to administration of swallow trials—is observation of the patient's current status. This includes posture (and observing typical feeding posture), respiratory effort and rate/rhythm, oxygen saturation levels, and supplemental/invasive oxygen use (and dosage and mode of delivery). With "baseline" data on these measures, the clinician can also record any changes that occur during feeding and swallowing observation. Furthermore, inquiries made to a caregiver or another health care professional (e.g., nurse) can also provide valuable information regarding current status and any changes to the patient's premorbid status.

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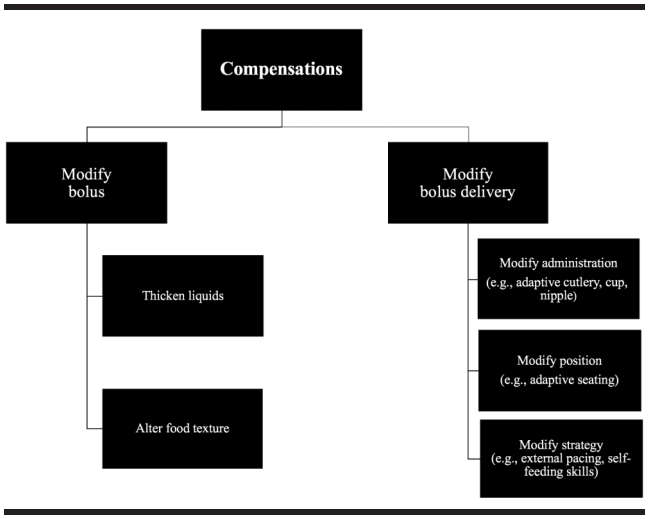
When clinicians are deciding whether to administer swallow trials using liquid/food items, the risks against the benefits from the information that may be gained must be considered. For example, an 85-year-old patient with advanced dementia admitted for chronic obstructive pulmonary disease exacerbation presenting at bedside with high supplemental oxygen requirements, confused state, and a weak cough likely has risks that exceed benefits possibly gained from completion of CSE. Therefore, an instrumental assessment would be warranted. This contrasts with the patient 25 years of age with a mild traumatic brain injury who is oriented, follows multistep commands, and presents with good cardiopulmonary function and strong cough. The younger patient's profile presents as low in risk and high in benefits gained, and thus, proceeding with bolus swallowing trials will likely yield clinically meaningful information without undue harm for the patient. Prior to proceeding with oral trials, oral care should be provided, particularly if the patient is at increased risk for aspiration and/or inadequate oral hygiene is appreciated. Routine oral care is crucial for all patients despite oral intake status and whether or not swallowing trials are provided during CSE. Evidence suggests oral care provides a preventative effect against pneumonia (Kaneoka et al., 2015). Determination of trials will be dependent upon the assessment prior to the point of administering swallowing trials. A small amount or small amounts of clean water consumed in a clean mouth will be the least harmful aspirant, but the clinician should also challenge the system to help identify (potential) impairment(s) and refer for instrumental examination when necessary. If a patient is experiencing aspiration, the clinician can assume aspiration of saliva is already occurring. Observations of signs (cough, change in vocal quality, etc.) that may be suggestive of dysphagia/aspiration should then be recorded throughout the entire CSE, not just during administration of bolus trials. The more signs present (e.g., abnormal cranial nerve exam, coughing), the higher the predictive value for aspiration, although signs of aspiration are not highly predictive of adverse outcomes in adults (Daniels et al., 2000; Martino et al., 2000). Observation throughout an entire session can allow the clinician to compare data obtained before, during, and after swallow trials. The reader is referred to previously published reviews about predictive values related to signs predicting dysphagia/aspiration, such as those by Brodsky et al. (2016), Calvo et al. (2016), Daniels et al. (2000), Martino et al. (2000), McCullough et al. (2005), and O'Horo et al. (2015).

Documentation of findings in the patient's medical record should be detailed regarding patient-specific risk factors for dysphagia/aspiration; method of administration of bolus trials (utensil, straw, etc.); signs/symptoms present, when signs/symptom occurred (e.g., immediately after the swallow), on what volume/consistency, frequency of occurrence; and recommendations (e.g., intake status, positioning, referral to other health care providers, referral for instrumental assessment). Any strategies attempted along with patient response should also be document. Common dysphagia compensations that may be applied are provided in Figure 2. The clinical report should provide a clear rationale of all recommendations made. Development of a CSE report template to be used facility-wide will allow for efficient reporting and improved communication with health care team members. It is suggested that a disclaimer be used within the clinical report to disclose that silent aspiration cannot be ruled out or determined during a CSE. Furthermore, as a reminder, pharyngeal and upper esophageal function can only be inferred during a CSE.

Reliability

All assessments of swallowing require clinical interpretation but, perhaps, none as much as the CSE. This opens the CSE up to concerns regarding reliability of measures. Both intra- and interrater reliability have been reported over the past two decades. Interrater reliability is more frequently reported due to the challenges associated with intrarater analysis, such as change in patient status over time and clinicians' inevitable memory of prior ratings that are challenging and difficult to blind. From the first report on intrarater reliability of collective CSE measures (McCullough et al., 2000), results were better than those for interrater reliability, indicating that clinicians develop their own internal standards in clinical assessments at which they are fairly consistent in applying. Subsequent studies reporting intrarater ratings have largely concurred, though few exist with the exception of ratings on specific measures/tools, such as the use of cervical auscultation (Bergström et al., 2014; Leslie et al., 2004). Interrater reliability, on the other hand, has been less impressive. With no prior training to criterion, less than half of measures may be reliable (McCullough et al., 2000). Previous reliability analyses using instrumental assessments have demonstrated that prior training to criterion can improve reliability of ratings

Figure 2. Therapeutic compensations often trialed empirically as part of clinical swallow examination.



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(Scott, Perry, & Bench, 1998); nonetheless, few studies over time have explored this relative to clinical measures. At least one study suggested that clinicians may be more reliable in making a global judgment of swallowing impairment after a complete CSE than with any one or two specific measures (McCullough et al., 2005). Depending on the clinician's purpose in administering the CSE, this factor may be critically important, as the goal of the CSE may very likely be to establish whether additional assessments are required rather than to determine what specific measures conclude about swallowing function. Experienced clinicians, despite inability to agree upon specific measures, appear to be better able to exercise overall clinical judgment regarding a patient and arrive at, minimally, a more reliable overall judgment of dysphagia. Though this does not mean that similar recommendations will ensue.

Research on specific clinical measures—and even collections of measures—has lessened over time. This is in part due to unimpressive results but also, in part, due to the rise in use of standardized assessments. Standardized assessments may not entirely eliminate variability (but should reduce!), nor do they remove the need for clinical skill and interpretation—and most would not purport them to do so. Yet, standardized CSEs with appropriate tool training for administration and interpretation can provide a more comprehensive, replicable, and validated approach to making global and some specific clinical judgments.

Standardized Clinical Swallow Evaluations

Implementation of a standardized approach for CSE procedures and documentation can help optimize patient care and allows for reliable and efficient reporting of findings. Three concepts relate to a standardized CSE: (a) what is a standard, (b) quantification, and (c) qualification. In this context, a standard is a measure or tool to which other similar measures/tools should conform. Seemingly simple, this concept places a high demand on the clinical tool. As a standard (or standardized tool), a CSE should have strong psychometric properties such as validity, reliability (see prior Reliability section), and more. Moreover, the tool should be robust in that the individual items are known to clinicians and may be easily taught to students. The results of this tool should be sufficiently straightforward to facilitate enhanced clinical communication and information sharing among clinicians—even those from other disciplines. Finally, the tool should be feasible across a range of clinical environments and contribute to a more efficient clinical assessment (e.g., reduced examination and documentation time; Porter et al., 2016).

The pursuit of standardization in assessment is not limited to dysphagia management. Different health care specialties have applied SCAMPs (standardized clinical assessment and management plans) in attempts to improve health care delivery, improve clinical outcomes, increase resource utilization efficiency, and in general decrease practice variation (Rathod et al., 2017; Simberloff et al., 2017). Related to the SCAMP concept are the consensus-based standards for the Selection of Health Status Measurement Instruments (Mokkink et al., 2016, 2010), which is focused on improving selection of outcome tools for both research and clinical practice via a set of consensus guidelines. One "outcome" of a standard CSE is reduced clinical variability. Unfortunately, clinical variation is not an easy concept to define or to change (Harrison et al., 2019). However, reducing clinical variation via a standard approach has been shown to improve patient safety in clinical medicine (Harada et al., 2017; Rozich et al., 2004).

Should dysphagia assessment follow trends in clinical medicine, a standard CSE would be expected to (a) demonstrate strong psychometric properties, (b) be robust and clinically efficient, (c) result in a measure easily communicated across professionals and environments, (d) reduce clinical variation, and (e) relate to meaningful outcomes. The Mann Assessment of Swallowing Ability (MASA) has demonstrated each of these features as a standardized CSE tool (Mann, 2002). The MASA has the potential to both quantify and qualify the presence and severity of dysphagia and has been associated with dysphagia-related morbidities (e.g., pneumonia).

The MASA is a 24-item clinical dysphagia examination incorporating recognized and commonly used items by dysphagia clinicians when performing CSEs with adult patients. Psychometric properties of the MASA as initially evaluated on a large adult sample of acute stroke patients are strong (Mann, 2002). Since the individual items are common, the MASA is efficient—requiring only a few minutes to complete. Results of this tool are both quantitative (a total score and dysphagia severity ratings; see Table 5) and qualitative (profile of strengths and weaknesses and change in clinical profile as an outcome; see Figures 3A and 3B). Because the scoring system has been psychometrically standardized, clinical variation is reduced. Finally, the results of the MASA are related not only to the presence and severity of dysphagia but also to the risk of pneumonia in at-risk populations (Chojin et al., 2017; Mitani et al., 2018). Furthermore, though the initial psychometric assessment was completed on adult patients after acute stroke, subsequent research has demonstrated feasible application of this tool to a variety of clinical populations (Ohira et al., 2017; Su et al., 2016). However, while the MASA may be appropriate for dysphagia related to neurological and perhaps age-related swallowing difficulties, a modification was necessary to evaluate dysphagia characteristics adequately in patients treated for head and neck cancer (Carnaby & Crary, 2014). Though many of the swallow-related items are similar between these related tools, the MASA-Cancer incorporates clinical items that are specific to difficulties experienced by patients treated for head and neck cancer. Like its neurological counterpart, the MASA-Cancer has strong psychometric properties in this target population.

One remaining question is "should we, as a profession, move toward standardization—even of clinical swallowing examinations?" No simple answer exists for this question, but a few relevant points can be brought into

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Table 5. Examples of quantitative results from a standardized clinical swallowing examination—Mann Assessment of Swallowing Ability.

Variable	Identification	Severity	Associated risks
Measure	Dysphagia: yes/no Total score out of 200 possible	Severity of identified dysphagia Total score out of 200 possible	Aspiration risk index Total score out of 200 possible
Cut-point or range	≤ 178	Mild: 168–177 Moderate: 139–167 Severe: ≤ 138	Mild: 149–169 Moderate: 141–148 Severe: ≤ 140

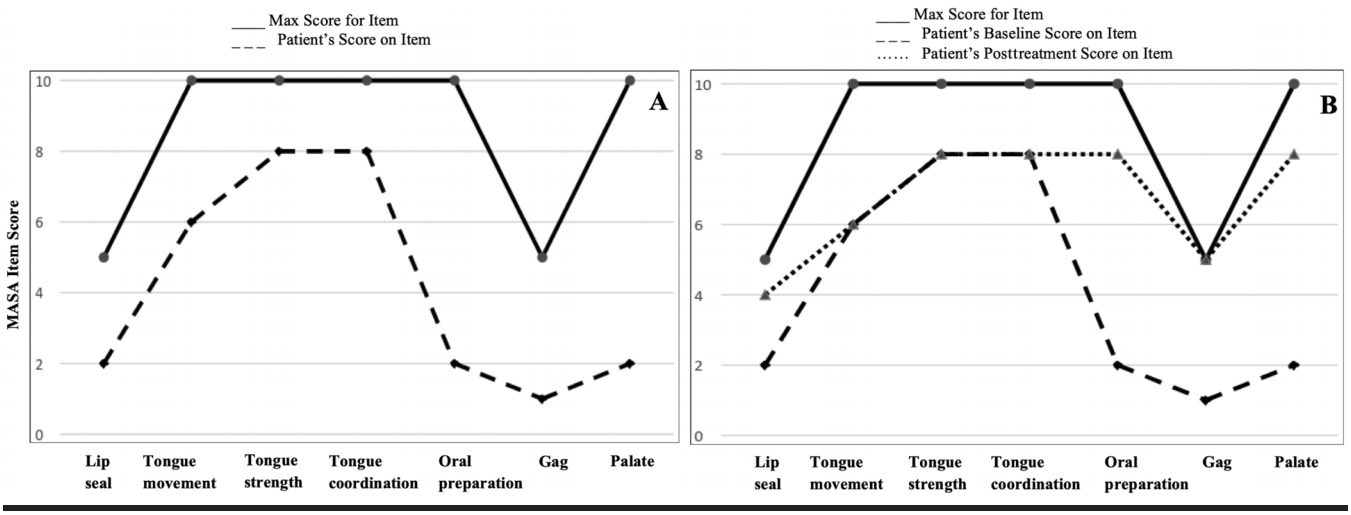
the discussion. CSEs are the cornerstone of dysphagia assessment. Martino et al. (2004) reported CSEs were completed on 71% of all patients referred for dysphagia evaluation compared to only 31% receiving instrumental (imaging) studies. One conclusion from this report is that the CSE may be helpful in determining who should receive an instrumental (imaging) study. The most frequent type of CSE was either "self-developed" (i.e., clinician-developed own tool) or "facility-developed" (i.e., clinician used what was already in place in a given facility; Carnaby & Harenberg, 2013). Thus, CSE tools are commonly used in dysphagia management, and the majority are "home-made" based on available literature. Limitations of this approach emerge when the evidence indicates poor reliability with scoring methods and poor agreement on even relatively simple observations (e.g., definition of a "wet-hoarse" voice) from CSEs (Mathers-Schmidt & Kurlinski, 2003). The risk of such inconsistencies is that the CSE as historically conducted is likely to result in diagnostic inaccuracy and subsequently negatively impact treatment plans.

Standardization of the CSE may not address all issues related to clinical dysphagia evaluations, but standardization offers distinct advantages. A standardized tool provides structure to clinicians. Once appropriately trained in tool administration and interpretation, the clinician will know what to expect and prepare accordingly. A standardized tool may be an effective and efficient teaching tool. By providing appropriate instructions to clinicians and to students, the historically poor reliability and low agreement on clinical observations noted in prior studies (see previous Reliability section) would likely be reduced. A standardized tool also has the advantage of enhancing communication among clinicians and across disciplines. Such items as "does this patient demonstrate a significant dysphagia," "how severe is the problem," "what is the clinical profile," and "what has changed as a result of treatment" all may be communicated effectively among clinicians using a common and standard tool. Finally, standardization does not mean a "one size fits all" approach. Variations can and should be developed for patient populations who present with different clinical profiles. These modified clinical tools should then be assessed thoroughly, as well as psychometric properties known to clinicians who may adopt them. Like many health care fields, adopting a standardized approach to clinical swallowing evaluations has potential to reduce clinical variability, enhance resource utilization, and improve patient outcomes.

Limitations

While the CSE can provide meaningful information to guide patient care, it is not without limitations that require serious consideration. No study, to our knowledge,

Figure 3. (A) Example of a clinical swallowing examination profile from an initial assessment (Mann Assessment of Swallowing Ability [MASA]). (B) Example of change in a clinical swallowing examination profile following treatment (MASA).



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has suggested that a CSE can solely elucidate pharyngeal or upper esophageal physiology, guide effective treatment options, and prevent the development of dehydration, malnutrition, pneumonia, and death across the life span. As Rogers once quoted, knowing "when to hold 'em….[and] when to fold 'em" (Schlitz, 1978) with a CSE is essential, as is knowing when to scope them and when to complete a videofluoroscopic examination. The result of such a decision may be influenced by a number of factors, including diagnosis and health status of the patient, as well as the availability of additional assessment options (i.e., availability of nasoendoscopy or videofluoroscopy equipment). It may also be influenced by the knowledge and experience of the clinician administering and interpreting the CSE. Though some clinicians may be comfortable attempting compensatory strategies and making treatment recommendations from a CSE, there are those that would never consider doing so.

During the CSE, the clinician does not have direct visualization of the swallowing process and, therefore, relies heavily on symptoms reported and signs observed (which can lead to false positives). One may infer dysfunction (particularly within the oral cavity), such as residue observed within the oral cavity, patient complaint of globus sensation, coughing, and so forth. However, the underlying nature contributing to these outward signs and patient-reported symptoms is not elucidated during a CSE. Furthermore, effectiveness of management strategies (e.g., chin tuck) employed during the CSE may falsely lead the clinician to believe in its effectiveness when it may facilitate either no benefit at all or further result in detrimental outcomes, such as continued aspiration. Without direct visualization, pharyngeal deficits, such as silent aspiration, cannot be detected, and aspiration with patient response does not allow the clinician to know why the aspiration occurred (i.e., what swallowing impairment(s) contributed to bolus airway invasion). Thus, while some specific physiological information can be gathered from an effective CSE, that information will be incomplete (Rangarathnam & McCullough, 2016). Without full understanding of the underlying impairment contributing to swallow dysfunction, development of a management plan will prove difficult.

The lack of standardization across clinicians and facilities limits generalizability of interpretations and reported findings. Similarly, lack of standardized training also leads to variability across clinicians related to interpretations and recommendations. This variability can lead to frustrations (and rightfully so!) by the patient/caregiver and health care professionals involved in the patient's care if clinicians devise different care plans because of the variability in the CSE performed and other limitations previously discussed.

Additional Testing and Referrals

After CSE completion, the clinician will need to decide if enough information had been obtained to diagnose a swallowing problem and develop a treatment plan, or if a referral or request for additional assessment(s; e.g., instrumental swallow study) needs to be made. Arguably, a strong reason for making the move to request additional assessment could be made if at any time there is evidence to suggest that the swallow is anything other than "normal" or "functional." If there is potential for adverse outcome(s) that cannot be identified and therefore effectively managed without instrumentation, then instrumental assessment is warranted. Furthermore, if there is any uncertainty, the clinician should err on the side of caution and refer to instrumentation. The CSE serves as an entry-level assessment, much like a physical examination at the primary care physician's office. If anything is considered to be potentially abnormal during the physical examination and there is need of further information, additional testing is recommended. Due to the limitations of the CSE, this is not necessarily a bad approach, although the information gained with instrumentation is only as good as the examiner performing and interpreting the study as well as acknowledgment that the sample of swallows is usually limited (which is beyond the scope of this article). And while few data exist supporting the appropriate referral or next step after CSE completion, clinical experience provides some guidelines (see Table 6).

This discussion is merely a guide. There may be situations where abnormalities are observed that would normally dictate additional testing when no follow-up is needed. It is advisable to ask oneself, "What would/should be changed in the care of this patient using information that will be provided from the next assessment or referral?" For example, referring back to the clinical case provided earlier, if the patient is an 85-year-old with advanced dementia, will there truly be a need to take big steps such as alternative alimentation or even small steps such as compensation strategies that cannot be followed? If the results of further assessment will not lead to changes in plan of care, then it becomes futile and should not be explored.

Other Considerations

The SLP is frequently the health care professional to evaluate and manage feeding and swallowing disorders in the United States across the life span. Other health care professionals, such as an occupational therapist, may also carry out clinical assessments of oral skills and swallowing function. It is vital the assessing clinician has extensive knowledge of the upper aerodigestive tract anatomy and physiology, with a firm understanding of typical and atypical development and function. A comprehensive clinical feeding and swallowing evaluation may be carried out by an individual clinician, but some individuals benefit from a team of professionals—each member bringing one's own extensive knowledge relevant to the respective clinical specialty. While team members may have extensive knowledge covering a broad range of systems (e.g., embryology, cardiopulmonary, gastrointestinal, craniofacial), each clinician functions within one's scope of practice and ethical

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Table 6. Common referrals needed based on clinical swallowing examination concerns.

Concern/purpose of follow-up	Referral	Additional considerations
Suspected bolus airway invasion (penetration/aspiration)	VFSS or FEES	
Determine appropriate compensatory strategies or assist in recommending safest consistencies for oral diet	VFSS or FEES	Either can provide appropriate guidance with experience Compensatory strategies should be tested under instrumentation to determine effects
Determine rehabilitation options based on impaired physiology	VFSS	Most complete view for defining oropharyngeal and upper esophageal physiology
Concern for esophageal dysfunction	Gastroenterology (GI): barium swallow (esophagram) and/or manometry Otolaryngology (ENT): upper esophageal function	Screening of esophageal function may be employed during VFSS in collaboration with radiology
Abnormal cranial nerve exam	Neurology	
Cognitive impairments	Neurology Neuropsychology	
Oral hygiene or dentition concerns, including ill-fitting dentures	Dentistry	
Nasopharyngeal or laryngeal structural concerns	Otolaryngology (ENT)	

Note. VFSS = videofluoroscopic swallowing study; FEES = fiberoptic endoscopic evaluation of swallowing; GI = gastrointestinal physician; ENT = ear, nose, and throat physician.

framework. For pediatric populations, team members may also include additional persons from outside the evaluating health care facility, including school-based teachers and therapists. Recommendations from team members are shared to ensure appropriate management decisions, including the potential need for timely additional medical/surgical, nutrition, and psychosocial assessments. No matter if the assessment is completed by an individual clinician or an interdisciplinary or multidisciplinary team, the patient/caregiver plays a crucial role in the evaluative and management process and therefore should always be included. "What matters most" to the patient/caregiver is fundamental in all decision making.

Additional Considerations for Clinicians Assessing Pediatric Populations

Feeding disorder is a broad term referring to infants and children demonstrating with feeding problems, which may or may not include dysphagia. Children may show sensory and/or behavioral resistances to food or fluid that may relate to past negative experiences, including prolonged hospitalizations, pain, and discomfort from medical/surgical procedures. All children with oral, pharyngeal, and/or upper esophageal dysphagia do have a feeding disorder but not necessarily the other way around (Arvedson et al., 2020). Dysphagia in pediatrics, as with adults, can result in a number of adverse consequences for those affected. For example, similar to the adult populations, children displaying laryngeal penetration and those displaying aspiration on videofluoroscopic swallowing study (VFSS) are at an increased risk of pneumonia (Weir et al., 2007).

Components of a Clinical Swallow Evaluation

It is imperative that assessment of feeding in infants and children incorporates parents and other caregivers as integral members of the assessment (and intervention) team as they serve as the primary feeders. Furthermore, caregivers are strong advocates for their child and know the child better than any other team member. Clinicians have a responsibility to carry out a through physical examination that includes not only specific oral sensorimotor characteristics but also inferences regarding possible contributions of upper airway and pulmonary factors, gastrointestinal considerations, status of nutrition, estimates of global developmental levels of functioning, and possible caregiver/child stressors.

Evaluation of pediatric dysphagia may also involve empiric trials, therapeutic strategies, and/or compensations (for older children who can follow directions), all of which should be documented in the CSE report. Many of the therapeutic strategies used with adults with swallowing impairment (e.g., supersupraglottic swallow), however, are not appropriate with young children. Younger children do not have the cognitive skills to understand or follow detailed instructions or the self-awareness for voluntary control for movements of anatomic structures. With older children, some positional strategies (with modeling) may be possible for trials (e.g., chin tuck, head turn), but in reality, these may be difficult to implement. Hence, clinical assessment trials in children generally focus on the usefulness of therapeutic compensations.

Reliability

In pediatrics, there is a strong argument that a CSE alone is not enough to detect aspiration risk, given the high

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rates of silent aspiration in this population (i.e., aspiration event that does not elicit a response, such as a cough; Arvedson et al., 1994; Newman et al., 2001). Reports in the pediatric literature suggest the CSE has a sensitivity and specificity of 86% and 32%, respectively, for detecting aspiration (e.g., da Silva-Munhoz et al., 2015), with lower sensitivity in detecting aspiration for solids compared to liquids (DeMatteo et al., 2005; Weir et al., 2009). Evidence suggests wet voice, wet breathing, and cough are the most predictive clinical signs of aspiration in children (da Silva-Munhoz, et al., 2015; DeMatteo et al., 2005; Weir et al., 2009), but these characteristics actually are not present in most patients who aspirate. Both age and neurological status appear to influence the significance of such clinical markers indicating potential of airway invasion (Weir et al., 2009).

Standardized Clinical Swallow Evaluations

Many clinicians assessing infants and children with swallowing and feeding difficulties rely on informal checklists based on typical oral skills and feeding development, along with their knowledge about neurophysiological sensorimotor learning principles. Although a number of pediatric feeding CSE tools are available, limitations must be noted and psychometric properties (validity and reliability) should be questioned for all assessments. Most of these assessments were developed to assist in classifying feeding skills of children with cerebral palsy and other neurodevelopmental disorders. Clinicians are urged to review the literature regularly for new assessment tools so they can evaluate reliability, validity, and evidence-based outcomes after implementation. Thus, it is with caution that the limited information on pediatric assessments tools provided here is based on available published systematic reviews.

Pados et al. (2016) carried out a systematic review of CSE tools used to assess feeding skills for neonates and young infants. Two assessments, the Early Feeding Skills (EFS) Assessment (Thoyre et al., 2005) and the Bristol Breastfeeding Assessment Tool (Ingram et al., 2015), had more supportive psychometric development and testing than other assessments reviewed (readers are urged to read these articles). Specifically, the EFS assessment is a checklist for assessing infant readiness for and tolerance of feeding. It also profiles the infant's developmental stage regarding specific feeding skills, for example, the ability to remain engaged in feeding, to organize oral–motor functioning, to coordinate swallowing with breathing, and to maintain physiological stability. Evidence suggests the EFS demonstrated good intra- and interrater reliability, as well as construct validity, and can be used with neonates and infants who are breastfed or bottle-fed (Thoyre et al., 2018). The Bristol Breastfeeding Assessment Tool is a concise breastfeeding assessment tool that facilitates accurate, rapid breastfeeding appraisal. It targets breastfeeding advice to mothers who are acquiring early breastfeeding skills or for mothers who are experiencing problems with an older infant. These authors stress that accurate assessment is essential to ensure enhanced breastfeeding efficiency and increased maternal self-confidence.

Benfer et al. (2012) carried out a systematic review of CSE tools used to assess "oropharyngeal dysphagia" in preschool-age children. This study found that the Schedule for Oral Motor Assessment (Reilly et al., 2000) and the modified Functional Feeding Assessment (Gisel, 1994) demonstrated stronger psychometric properties of validity and reliability compared to other tools included in the review. The Schedule for Oral Motor Assessment (Reilly et al., 2000) and the Dysphagia Disorders Survey (Sheppard, 2003) developed for older children and adults (aged 8 years and above) with developmental disabilities were found to have stronger clinical utility than other tools reviewed. The authors concluded additional research is needed to test psychometric properties of tools, in particular, test–retest reliability and predictive validity (Benfer et al., 2012). As similar to the adult populations, it must be emphasized that observations of oral feeding during a clinical evaluation, as well as during intervention, can only infer pharyngeal swallow function. Instrumental swallow assessments are needed to delineate pharyngeal and upper esophageal swallow function.

Limitations

As previously mentioned, across the pediatric population, there is a high incidence of silent aspiration, referring to an aspiration event that does not elicit a response (e.g., cough). Literature suggests that, in general, approximately 25%–40% and as high as 94% of children referred for VFSS are found to aspirate (Arvedson et al., 1994; Uhm et al., 2013; Velayutham et al., 2017; Weir et al., 2011) and that of those found to aspirate on VFSS, approximately 80%–94%, demonstrate silent aspiration (Arvedson et al., 1994; Uhm et al., 2013; Velayutham et al., 2017; Weir et al., 2011). The rate of silent aspiration is highest in infants aged less than 6 months, in whom approximately 95% of those who aspirate do so silently (Velayutham et al., 2017). Other high-risk populations include children with trisomy 21 and children with Prader-Willi syndrome. In patients with trisomy 21, approximately 55% of children referred for VFSS are found to aspirate or have deep laryngeal penetration, and of those found to aspirate on VFSS, 90% demonstrated silent aspiration (Jackson et al., 2016). In children with Prader-Willi syndrome, approximately 88% of those referred for VFSS were found to aspirate, and of those found to aspirate, all (100%) demonstrated silent aspiration (Salehi et al., 2017). Other populations that have been identified as at increased risk of silent aspiration include children with congenital heart disease, structural abnormalities (laryngeal cleft, laryngomalacia, unilateral vocal fold paralysis), and neurological deficits (epilepsy/seizures, developmental delay; Velayutham et al., 2017).

Furthermore, in young infants, suspicion of dysphagia and aspiration is often based on ongoing adverse clinical signs (e.g., ongoing supplemental oxygen requirement, ongoing tube feeding requirement, food/ fluid aversion, coughing

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and/or choking). In fact, dysphagia and aspiration in children are sometimes incidental findings. Evaluation of patients for gastroesophageal reflux by upper gastrointestinal studies revealed that 13% of children demonstrated airway invasion (penetration/aspiration; Mercado-Deane et al., 2001). In children with unexplained respiratory problems who subsequently were diagnosed with dysphagia on VFSS, approximately 60% aspirated (others displayed laryngeal penetration only), and all who aspirated (100%) did so silently (Lefton-Greif et al., 2006). Many would argue these findings would justify a low threshold for considering imaging/instrumental assessment in these populations. Additionally, there is limited predictability in infants and young children, particularly in the first year of life. More normative data are needed to aid clinicians identifying typical from atypical feeding and swallowing behaviors.

Additional Testing and Referrals

Multiple factors can impact decision making regarding proceeding with imaging/instrumental assessment for pediatric patients. One factor is the patient's ability to participate in decision making. Infants and young children are not capable of making these decisions, and older children may be capable of informed assent, but legally, they cannot consent. Hence, caregivers and clinicians generally make decisions on behalf of children. When making these decisions, one has to consider the pros and cons of performing imaging/instrumental assessment, which can involve radiation risk (e.g., VFSS) or discomfort (e.g., fiberoptic endoscopic evaluation of swallowing) (da Silva et al., 2010; Suterwala et al., 2017). This decision making involves weighing the risks versus benefits of thorough assessment and appropriate management. Particularly in children, one has to consider the implications of unidentified and unmanaged dysphagia, both in the short term and in the long term. Dysphagia and aspiration can contribute to life-long pulmonary changes. Insufficient intake can contribute to growth faltering and impaired neurodevelopment. Food and/or fluid aversion can result in mealtime disturbances and potentially reliance on tube feeds (Goday et al., 2019). Given the high stakes involved, many would argue for a low threshold in proceeding to imaging/instrumental assessment in children with signs and symptoms of dysphagia and/or unexplained respiratory symptoms (e.g., Duncan et al., 2017, 2018).

Other Considerations

Children referred for VFSS and demonstrated with bolus (ingested material) airway invasion had significantly increased risk of pneumonia (Gurberg et al., 2015). In particular, risk of pneumonia was significantly increased in those who displayed laryngeal penetration/aspiration on VFSS in addition to other health issues—gastroesophageal reflux disease, oxygen supplementation, asthma, and Down syndrome (Weir et al., 2007). It appears the relationship between aspiration and pneumonia is somewhat less direct in infants than in older children. Clinically, many neonates and infants who have documented aspiration do not develop pneumonia but may display signs of pneumonitis (i.e., they may present with tachypnea/increased work of breathing, but less likely fever and productive cough; Dodrill, 2011). Presumably, pneumonitis is related to the fact that neonates and young infants neither have teeth nor eat food and, hence, are less likely to have harmful bacteria in the material they aspirate, including aspiration of refluxed gastric contents.

Conclusion

Specific guidelines for carrying out a clinical feeding and swallowing evaluation require systematic decision making with considerations for high degree of variability within and across adult and pediatric patient populations. The CSE is not only a useful tool but a critical one. As aptly noted, "it is critical that the CSE not be relegated to the status of a screening tool. It is far too powerful" (Rosenbek et al., 2004). The CSE is often the first complete physical assessment of swallowing function for a patient where critical information is gathered and should not be overlooked. A thorough CSE extends beyond watching someone eat and drink; it is a multidimensional assessment. While reliability of individual measures remains questionable, the experienced clinician can make important judgments regarding patient safety that will help chart the course of care for individuals needing additional assessment and, possibly, intervention. Employing a standardized CSE tool after sufficient training will further enhance clinical decision making. As instrumental examinations are more costly, more invasive, and less available, the CSE can also serve to chart progress, or lack of progress, over time when it is conducted methodically and consistently.

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