COORDINATED STROKE STRATEGY

Management of Dysphagia in Acute Stroke

An Educational Manual for the Dysphagia Screening Professional

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HEART AND STROKE FOUNDATION OF ONTARIO

Finding answers. For life.

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Heart and Stroke Foundation of Ontario 1920 Yonge, Street, 4th Floor, Toronto, ON M4S 3E2 Tel: 416-489-7100; Fax: 416-489-6885
E-mail: heartandstroke@hsf.on.ca www.heartandstroke.ca

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Foreword

The Ontario Stroke System is a comprehensive stroke strategy with the goal of providing the best possible care to all individuals who suffer a stroke anywhere in the province. One important aspect of this strategy is improving the recognition and management of dysphagia, or difficulty swallowing.

Dysphagia is one of the most common sequelae following acute stroke, affecting as many as 50% of patients.[1] Dysphagia may resolve within 14 days after stroke or it may persist for longer periods of time. In Canada in 1994, it was estimated that dysphagia was present in 15,000-21,000 new stroke patients older than 65 years of age, and that only half of these individuals would recover within the first week, with the other half living with dysphagia for months after the stroke.[2] Also, as the Canadian population ages, the incidence of new stroke with dysphagia is expected to continue increasing over the next few years.

The presence of dysphagia in stroke survivors has been associated with increased mortality and with morbidities such as malnutrition, dehydration and pulmonary compromise.[1, 3-9] However, emerging evidence indicates that early detection of dysphagia in acute stroke survivors improves outcomes such as pneumonia, mortality, length of hospital stay and overall health care expenditures.[2]

The Heart and Stroke Foundation of Ontario, as part of its commitment to realizing a comprehensive stroke strategy, has convened an expert panel to develop a series of educational resources on the management of dysphagia in acute stroke. *Management of Dysphagia in Acute Stroke, An Educational Manual for the Dysphagia Screening Professional* has been developed for registered nurses (RNs), registered practical nurses (RPNs), occupational therapists (OTs), physiotherapists (PTs), and registered dietitians (RDs) caring for stroke patients in acute hospitals alongside a dysphagia expert such as a speech-language pathologist (SLP).

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Rosemary Martino, MA, MSc, PhD
Speech Language Pathologist
Assistant Professor
University of Toronto
University Health Network
Toronto, Ontario

Anna Mascitelli, MA
Speech Language Pathologist
Regional Dysphagia Pilot Project Coordinator
Niagara Health System
St. Catharines, Ontario

Patricia Knutson, MA
Speech Language Pathologist
Regional Dysphagia Pilot Project Coordinator
Grand River Regional Hospital
Kitchener, Ontario

Beverley Powell-Vinden, RN, MEd
Senior Specialist, Professional Education,
Coordinated Stroke Strategy
Heart and Stroke Foundation of Ontario
Toronto, Ontario

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Acute Stroke and Dysphagia

Implementation of optimal stroke care includes identifying and managing dysphagia. Dysphagia may be evident immediately after a stroke, or it may develop during the first few days after a stroke. Studies indicate that almost 50% of acute stroke patients have some degree of dysphagia within the first 72 hours after the stroke.[10]

Undetected dysphagia may lead to potentially serious medical complications, including dehydration, malnutrition and aspiration pneumonia.[3,5,6,8,10] Evidence supports the importance of identifying and managing dysphagia in stroke survivors as a strategy to reduce these complications.[2,11-13] Dysphagia is also associated with an increased length of hospital stay, institutional care and increased mortality.[1,9] As a result, promptly detecting dysphagia and instituting appropriate management strategies is expected to shorten length of stay and reduce medical complications[2]

Vision for Dysphagia Management

The Heart and Stroke Foundation has identified the following vision for identifying and managing dysphagia in acute stroke survivors in Ontario:[12]

> *All stroke survivors will have access to rapid and timely [swallowing] screening to minimize the development of complications. Stroke survivors who have a positive result from screening will have access to a rapid and timely comprehensive dysphagia assessment by a [dysphagia expert]. Those stroke survivors found to have dysphagia will receive appropriate individualized and nutritional management that meets the best practice guidelines for managing dysphagia.*

Because Ontario has a shortage of dysphagia experts, for example, speech-language pathologists (SLPs), achieving this vision requires the creation of interdisciplinary dysphagia teams trained to identify dysphagia risk and collaborate with dysphagia experts to manage dysphagia in acute stroke survivors.[12]

It has been proposed that every hospital create an interdisciplinary dysphagia team. Smaller community hospitals without dysphagia experts would have access to regional SLP dysphagia experts to support the team and provide assessment for individuals with dysphagia. The team could include a physician (MD), registered nurse (RN), registered practical nurse (RPN), occupational therapist (OT), registered dietitian (RD), physiotherapist (PT) and either an on-site or regional SLP. The team members would be trained to:

- Screen all newly admitted conscious acute stroke patients
- Refer patients with a positive screen to the SLP dysphagia expert
- Act as a contact / resource for family and staff.

Best Practice Guidelines for Managing Dysphagia

The best practice guidelines, developed through a consensus process, provide a benchmark against which organizations involved in stroke care can measure their progress in improving the management of dysphagia after acute stroke.[12]

1. Maintain all acute stroke survivors NPO until swallowing ability has been determined. NPO prohibits the administration of oral medications, water and ice chips. Intravenous fluids may be required. Regularly perform mouth-clearing or oral care procedures to prevent colonization of the mouth and upper aerodigestive tract with pathogenic bacteria. Minimal amounts of water can be used to wet utensils before inserting them into the patient's mouth.

2. Screen all stroke survivors for swallowing difficulties as soon as they are awake and alert. An RN, RD, RPN or other dysphagia team member trained to administer swallowing screening tests and interpret results, should perform the screening.

3. Screen all stroke survivors for risk factors for poor nutritional status within 48 hours of admission. An RN, RD, RPN or other dysphagia team member trained to administer nutritional screening tests and interpret results, should perform the screening.

4. Assess the swallowing ability of all stroke survivors who have a positive result on swallowing screening. The assessment includes a clinical bedside examination and, if warranted by the clinical signs, an instrumental examination. A SLP dysphagia expert, in consultation with other team members, should:

   - Assess the stroke survivor's ability to swallow food, liquid and medications
   - Determine the level of risk of dysphagic complications, including airway obstruction, aspiration of food and liquid, and inadequate nutrition and hydration
   - Identify associated factors that could interfere with adequate oral nutrition and hydration or lead to aspiration-related complications, such as impaired motor skills, cognition or perception
   - Recommend appropriate individualized management, which may include changes in food or fluid consistency, feeding strategies, swallowing therapy, oral care regimens and possibly referral to other health care professionals.

5. Provide feeding assistance or mealtime supervision to all stroke survivors who have a negative screening. An individual trained in low-risk feeding strategies should provide this assistance or supervision.

6. Assess the nutrition and hydration status of all stroke survivors with a positive screening. The stroke survivor's MD may monitor hydration status, initiate appropriate laboratory investigations and order supplementary intravenous fluid administration. An RD should:

   - Assess energy, protein and fluid needs
   - Recommend alterations in diet to meet energy, protein and fluid needs in accordance with allowable food texture and fluid consistancy.

7. Reassess all stroke survivors receiving modified texture diets or enteral feeding for alterations in swallowing status regularly. After the acute stroke management phase, usually the first week after the stroke, reassess patients at *minimum* intervals of every two to three months during the first year after the stroke and then every six months thereafter. The severity of swallowing impairment and the rate of improvement may alter the reassessment schedule.

8. Explain the nature of the dysphagia and recommendations for management, follow-up and reassessment upon discharge to all stroke survivors, family members and care providers.

9. Provide the stroke survivor or substitute decision-maker with sufficient information to allow informed decision making about nutritional options. Consider the wishes and values of the stroke survivor and family concerning oral and non-oral nutrition when developing a dysphagia management plan.

Review Questions

1. Typically, what percentage of acute stroke survivors has dysphagia?

2. At what point after hospital admission is it appropriate to screen a newly admitted stroke survivor for dysphagia?

3. When should stroke survivors with risk factors for poor nutritional status be screened?

Swallowing: Anatomy, Physiology and Pathophysiology

Normal Swallowing

Efficient swallowing involves the integration of sensory input and motor activity in the mouth and surrounding anatomic structures. The sensory components include the perception of taste, viscosity, temperature, smell and tactile input from the teeth, oral mucosa and tongue.[14] Eating involves two motor processes: feeding, which entails recognizing food and drink and transporting it to the mouth; and swallowing, which involves moving food from the mouth to the stomach, without interfering with breathing.[15]

Anatomy

Swallowing is a complicated process that involves the oral cavity, pharynx, larynx and esophagus (Figure 1). This process is the product of a series of events that require an intact nervous system and adequate musculature for initiation, facilitation and conclusion of a safe swallow.[16]

The oral cavity begins at the lips and includes the teeth, gums, tongue, hard palate and soft palate, the

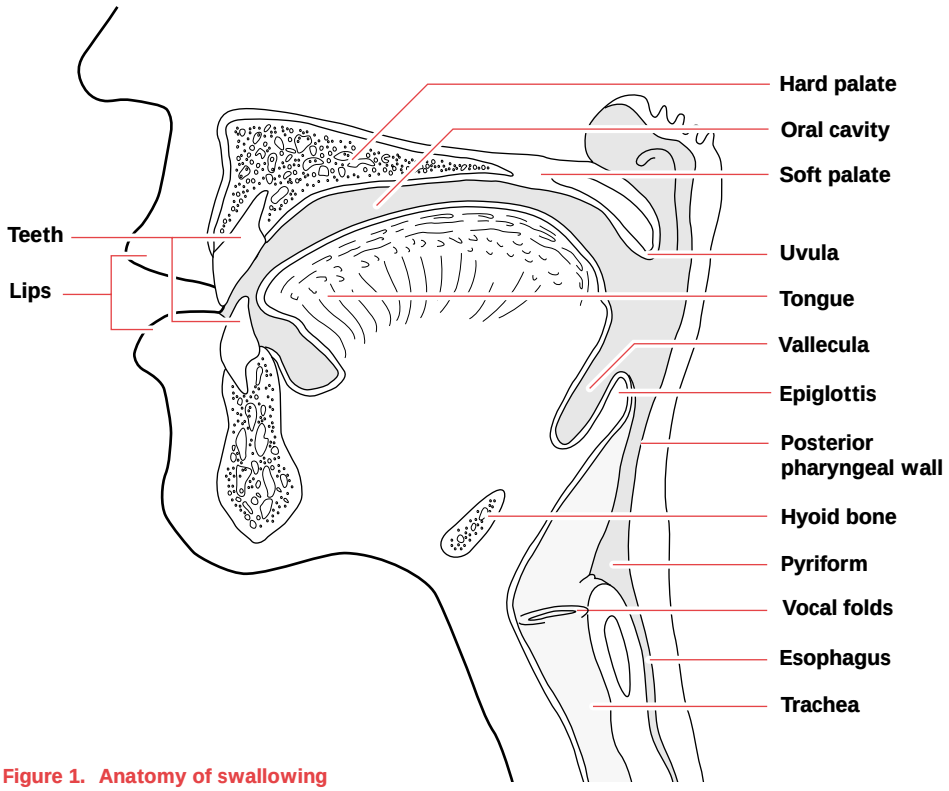

Figure 1. Anatomy of swallowing

uvula (velum), faucial arches and cheek muscles. The oral and nasal cavities are connected at the back of the throat by a passage with a valving action that closes during swallowing. This valving action prevents food and liquid from entering the nasal cavity. Also, within the oral cavity are three pairs of large salivary glands: the parotid, submandibular, and sublingual glands. Saliva produced by these glands maintains oral moisture, reduces tooth decay, assists with digestion and neutralizes stomach acid.[17]

The pharynx, or throat, is a muscular tube that is involved both in ingesting food and breathing. The pharynx is divided into the nasopharynx, oropharynx, and hypopharynx. The base of the tongue forms the front of the pharynx, and lateral and posterior muscular walls enclose the pharynx. The pharyngeal spaces include the valleculae and pyriform sinuses. The pharyngeal muscles, including the superior, medial and inferior pharyngeal constrictors, help propel food through the throat toward the esophagus. [17]

The larynx is located at the front of the neck, directly in front of the junction between the pharynx and esophagus. It is just above the trachea, and is often called the voice box. It acts as a direct conduit for air to the lungs. Functions of the larynx are varied and include the following:[17]

- Passage for inhaled and exhaled air
- Role in voice production
- Prevention of foreign objects, including food, from entering the trachea, and expulsion of any inhaled foreign objects
- Pressure-regulating valve, allowing safe and efficient swallowing.

The esophagus is a collapsed muscular tube with sphincters at both ends; the upper esophageal sphincter (UES) and the lower esophageal sphincter (LES). The esophagus transports food from the pharynx to the stomach. Opening of the UES initiates the esophageal phase of swallowing. Esophageal peristalsis helps to push the food and drink toward the stomach. Closing of the LES completes the esophageal phase of swallowing and prevents regurgitation, or reflux, of stomach contents, including acid, into the esophagus.[18]

Physiology

Effective swallowing depends on the coordinated action of 25 pairs of muscles primarily controlled by 5 cranial nerves: the trigeminal (V), facial (VII), glossopharyngeal (IX), vagus (X) and hypoglossal (XII).[19]

Stages of Swallowing

Swallowing physiology can be divided into 4 stages: the oral preparatory stage, the oral propulsive stage, the pharyngeal stage and the esophageal stage. The oral stages of swallowing involve voluntary actions, and the pharyngeal and esophageal stages of swallowing involve involuntary actions.[19]

Oral Preparatory Stage

The oral preparatory stage involves the muscles of the lips, cheeks and mandible, the teeth, and the tongue. The teeth and muscles of the mouth masticate the food and form it into a bolus. Sensory information about taste, temperature and texture stimulate production of saliva, which adds moisture to bind the bolus. Papillae on the tongue also provide sensory information that helps to prepare the bolus to the right size and consistency. The tongue holds the bolus against the anterior hard palate, while the lips and jaw close, sealing the mouth (Figure 2). Liquids are also formed into

Figure 2.
Oral preparatory stage of swallowing

a bolus. The duration of the oral preparatory stage varies, depending on the amount and texture of the food and individual eating habits. This is the stage of swallowing from which most people derive the greatest pleasure.

Oral Propulsive Stage

The oral propulsive stage of swallowing begins when the tongue, the primary muscle in the oral stage, begins transporting the bolus from the oral cavity, through the pharynx, to the esophagus. The tongue elevates, from an anterior to posterior direction, with the surface of the tongue pushing against the hard palate and squeezing the bolus posteriorly until it reaches the pharynx (Figure 3).[21]

Figure 3.
Oral propulsive stage of swallowing

Pharyngeal Stage

When the bolus reaches the area of the anterior faucial arches, located at the level of the tonsils along the sides of the throat, the pharyngeal stage of swallowing is triggered. This stage of swallowing is reflexive, and it occurs quickly, typically in less than two seconds. The velum elevates against the nasopharyngeal wall, triggering velopharyngeal closure and preventing solids and liquids from entering the nasal cavity (Figure 4a). Within the larynx, the vocal cords close, preventing food from entering the trachea or airway. The airway is further protected by the backward movement of the epiglottis, which directs food into the esophagus and away from the larynx. The larynx elevates, assisting in opening the UES (Figure 4b). The bolus moves quickly and smoothly through the pharynx and its spaces, the valleculae and pyriform sinuses (Figure 4c). At the end of the pharyngeal stage, the bolus passes to the esophagus.[17,21]

Figure 4.
a) Velum elevates against nasopharyngeal wall, triggering velopharyngeal closure. b) Vocal cords close, epiglottis lowers, and larynx elevates. c) Bolus moves quickly and smoothly through the pharynx.

Esophageal Stage

During the esophageal stage of swallowing, the bolus is propelled down the esophagus by waves of peristaltic contractions. It takes 8 to 20 seconds for the bolus to travel from the UES to the LES, making the esophageal stage considerably longer than the pharyngeal stage (Figure 5). After the bolus enters the stomach, the LES closes, preventing gastroesophageal reflux.

Figure 5.
Bolus is propelled down the esophagus

Coordination of Swallowing, Speaking and Breathing

Swallowing, speaking and breathing are three basic human functions that use many of the same anatomical structures. For example, the lips produce sounds, but they can also prevent food or liquid from leaking from the mouth during mastication. The tongue is involved in speech, and it also propels the bolus posteriorly into the pharynx and esophagus during swallowing. The larynx produces the voice, but it also seals the airway during swallowing, so that food and liquid do not enter the lungs.

An important reciprocal relationship exists between the functions of breathing and swallowing, as they use many of the same muscles. Air flows into and out of the lungs through the nasal passages and the pharyngeal cavity. The pharynx, however, is a shared passage for the movement of air and for the transport of food and liquid into the esophagus. The larynx also plays a dual role: it protects the airway from food and liquid during swallowing, and it maintains a patent airway for effortless breathing. During swallowing, the larynx closes the airway through a series of valving actions. The epiglottis deflects downward to direct food and liquid into the esophagus and the vocal cords contract to close off the trachea.

Breathing therefore stops for a fraction of a second during the transition from the pharyngeal to the esophageal stage of swallowing.[22] This pause in breathing is known as swallowing apnea. Swallowing apnea begins with airway closure when the bolus reaches the lower pharynx, or hypopharynx, and finishes when the last of the bolus enters the esophagus.[23] The length of the apneic period increases with bolus size.[24] The timing of swallowing and breathing must be coordinated to prevent inhalation of food or liquid. Changes in muscle strength and timing can affect this coordination.

Swallowing in the Elderly: Presbyphagia

Aging is a systemic process that affects physiologic functions to varying degrees. Age-related changes that can affect swallowing result from reduction in muscle tone, loss of elasticity of connective tissue, decreased saliva production, changes in sensory function and decreased sensitivity of the mucosa.[25] In healthy individuals, age-related changes in swallowing are known as primary presbyphagia.[16]

Changes in skeletal muscle function and neural inputs to muscle begin around 50 to 60 years of age, but the most significant loss of muscle strength, approximately 30%, occurs between 50 and 80 years of age as muscle mass diminishes.[17] These age-related changes reduce motility of the pharyngeal and esophageal muscles, changing the movements of the epiglottis, reducing closure of the vocal cords and altering UES function. In addition to these physiologic changes, older adults have a higher rate of structural abnormalities that can also affect the pharyngeal and esophageal stages of swallowing, such as pharyngeal webs and diverticula; osteophytes; cervicothoracic kyphoscoliosis; and rheumatoid arthritis.[20] In addition, poor dentition or poorly fitting dentures can impair the oral stages of swallowing.[26]

Healthy elderly individuals can compensate for presbyphagia.[27] However, when presbyphagia is compounded by changes resulting from fatigue or weakness or from a concomitant disease process, such as stroke, dysphagia can result.[20] The prevalence of dysphagia in healthy individuals 60 to 95 years of age is estimated to be 8 to 16%[17], and yet it is estimated to occur in more than 50% of acute stroke survivors.[3,10,28]

Impaired Swallowing: Dysphagia

Dysphagia is defined as difficulty or discomfort in swallowing, and the term describes a set of symptoms or signs related to changes in swallowing. Any motor, sensory or structural changes to the swallowing mechanism can result in impaired swallowing. Dysphagia is one of the most common sequelae of acute stroke, affecting as many as 50% of acute stroke survivors.[10,29,30] Individuals with stroke may have reduced cognitive abilities, advanced dementia, reduced ability to sequence swallowing patterns or may not recognize the purpose of food. Stroke can affect any or all of the stages of swallowing, thus affecting an individual's ability to eat and drink safely.

Cranial Nerve Dysfunction in Dysphagia

Stroke can create neurological deficits that affect the function of the cranial nerves that innervate muscles of the swallowing mechanism.[31] As a result, stroke can exacerbate normal age- or disease-related changes already present in the swallowing mechanism and result in dysphagia.

Trigeminal Nerve: Cranial Nerve V

The trigeminal nerve innervates the tongue and mandible. Thus, this nerve is involved in sensing the bolus and moving the mandible. Trigeminal nerve dysfunction can result in loss of texture sensations and an inability to move the mandible for mastication.

Facial Nerve: Cranial Nerve VII

The facial nerve innervates several facial structures, including the lips and cheek muscles as well as the tongue. This nerve is involved in pursing the lips, an action that is necessary to seal the oral cavity and prevent drooling. The facial nerve is involved in holding the cheeks tightly against the gums during chewing, which prevents pocketing of food in the space between the cheeks and gums. The facial nerve also recognizes tastes when the bolus is on the anterior tongue.

Glossopharyngeal Nerve: Cranial Nerve IX

The glossopharyngeal nerve innervates the posterior part of the tongue and oropharynx. Nerve dysfunction results in loss of taste and texture sensation and in delayed triggering of the pharyngeal stage of swallowing.

Vagus Nerve: Cranial Nerve X

The vagus nerve innervates the pharynx, larynx and upper esophagus. This nerve is vital in triggering the pharyngeal stage of swallowing and in propelling the bolus through the pharynx and upper esophagus. The vagus nerve also contracts the vocal cords, sealing the trachea and protecting the airway from food or liquid.

Hypoglossal Nerve: Cranial Nerve XII

The hypoglossal nerve innervates the tongue and is involved in preparing and propelling the bolus through the oral and pharyngeal cavities. Dysfunction of this nerve causes an inability to control food in the oral cavity during mastication and inability to propel food through the mouth and pharynx. Therefore, hypoglossal dysfunction may result in food residue on the surface of the tongue and in the pharyngeal cavity.

Types of Dysphagia

Oral Dysphagia

Oral dysphagia refers to changes affecting the voluntary, or volitional, stages of swallowing, during which movement of the bolus can be controlled. Acute stroke can cause oral dysphagia through a variety of mechanisms. Hemiparesis and apraxia can affect this volitional movement. Stroke can also affect underlying oral processes and sensations involved in swallowing, such as salivary flow, and taste and temperature sensitivity.[20]

Oral Preparatory Dysphagia

A stroke may reduce the strength, coordination and control of oral muscles involved in swallowing, decreasing the stroke survivor's ability to manipulate food and form a bolus (See Fig. 2, page 9). Dysphagia is also present if the oral preparatory stage is delayed. The signs of oral preparatory dysphagia include the following:

- Inability to take food from a spoon cleanly or drink from a cup without spillage
- Inability to close lips firmly to maintain a lip seal
- Reduced saliva production – dry appearance to mouth, inability to form bolus when eating dry foods
- Poor tongue control or weakness – tongue deviation or inability to elevate tongue
- Weakness in cheek muscles – flaccid or drooping cheeks
- Poor taste sensation – complaints of taste of food, refusal to eat
- Loose dentures or poorly fitting dentures – reduced lingual control and effectiveness of mastication, as the tongue holds dentures in place during swallowing
- Missing teeth or no teeth (edentulous) – reduced ability to chew solid foods

Oral Propulsive Dysphagia

During the oral propulsive (or transit) stage, the tongue transfers the bolus of food or liquid from the oral cavity to the pharynx, triggering the pharyngeal stage of swallowing (See Fig. 3, page 10). Dysphagia is present if the oral propulsive stage is delayed, taking more than 2 seconds to complete.[20] Other signs of oral propulsive dysphagia include the following:

- Pocketing of food in spaces between the gums and cheeks
- Abnormal tongue movements – tongue pumping to initiate swallowing or inability to move tongue posteriorly
- Food or drink running from nose
- Excessive secretions, drooling – inability to move secretions posteriorly to swallow, causing appearance of excessive saliva

Pharyngeal Dysphagia

During the pharyngeal stage of swallowing, the bolus moves from the oral cavity to the esophagus. Pharyngeal dysphagia may be difficult to identify without instrumentation because the affected anatomical structures and processes are not easily seen. A coordinated series of events, involving complex movements of the tongue and pharyngeal structures, propels the bolus into the esophagus while protecting the airway (See Fig. 4, page 10). Alterations in neural function, muscle coordination or timing of the pharyngeal stage of swallowing can each contribute to pharyngeal dysphagia. The pharyngeal stage of swallowing can be delayed if the bolus does not trigger the pharyngeal swallow. Because the signs are subtle, caregivers may not suspect pharyngeal dysphagia, especially if the oral stages of swallowing are unaffected. The signs of pharyngeal dysphagia include the following:

- Slowness or delay in triggering swallowing – sometimes noted with delayed elevation of the thyroid notch, located at the superior end of the thyroid cartilage
- Reports of a sticking sensation in the throat
- Throat clearing, coughing, choking when eating or drinking
- Weak cough when eating or drinking
- Difficulty swallowing – gulping
- Changes in vocal quality – wet, gurgly, hoarse sounds when eating or drinking
- Breathing difficulties – shortness of breath during meals.

Esophageal Dysphagia

Esophageal peristalsis propels the bolus from the UES, through the esophagus and past the LES toward the stomach (See Fig 5, page 10). The LES relaxes, allowing the bolus to pass, but contracts again immediately after the entire bolus enters the stomach to prevent gastroesophageal reflux. The esophageal stage of swallowing may be prolonged if the bolus takes longer than normal to travel to the stomach. Esophageal dysphagia can also be characterized by retention of food in the esophagus caused by a mechanical obstruction, motility disorder or impaired LES function. The signs of esophageal dysphagia include the following:

- Feeling of food getting stuck in throat or chest
- Reflux of food into the throat or mouth
- Heartburn
- Report of sour taste in mouth, especially in morning.

Complications of Dysphagia

Aspiration

Aspiration occurs when food or liquid enters the trachea.[32] Signs of aspiration include coughing, shortness of breath, difficulty breathing and respiratory complications.[33-35] Malnourished individuals have a higher risk of aspiration, because muscles are weakened, reducing the strength of respiration, throat clearing and coughing.[36] Silent aspiration, a concern in individuals with reduced laryngeal sensation, occurs when a bolus enters the trachea without producing coughing, throat clearing or changes in vocal quality.[36,37] Silent aspiration may go undetected unless a videofluoroscopic swallowing study (VFSS) is performed or respiratory complications consistent with aspiration develop.[39]

Aging affects both breathing and swallowing, increasing the risk of aspiration.[40] These normal changes are compounded by stroke, chronic obstructive pulmonary disease (COPD), and other medical conditions.[41-43]

Aspiration Complications

Dysphagia is strongly associated with aspiration pneumonia, a pulmonary infection caused by the entry of foreign substances and/or bacteria into the lungs. This common respiratory complication following stroke is associated with repeated entry of food or liquid into the lungs due to abnormal swallowing physiology.[44-46] Not everyone who aspirates develops aspiration pneumonia. Factors affecting the likelihood of aspiration pneumonia include stroke severity, level of consciousness, premorbid pulmonary function, ability to cough, mobility, posture, cognition, acidity of the aspirate, immune competence, oral hygiene and amount and frequency of aspiration.[39,47] Other risk factors include dependency on others for oral care or feeding, dental caries, tube feeding and medical conditions, such as COPD, cancer, malnutrition, cardiac disease, diabetes mellitus and multiple

strokes.[39,48] The risk of aspiration pneumonia is affected by the following factors:[46,48]

- Quantity of the aspirated bolus
- Physical properties of the aspirated bolus: acidic, sticky or laden with bacteria
- Depth of aspiration: trachea versus lungs
- Integrity of pulmonary clearance: ciliary action and coughing, with a weaker cough reflex associated with a greater risk of pneumonia.

Other respiratory complications associated with dysphagia include pneumonitis and bronchitis. Pneumonitis is an acute lung injury, typically caused by a single inhalation of regurgitated gastric contents or a foreign substance. Swallowing structure and physiology may be normal. Aspiration pneumonitis produces a chemical burn of the tracheobronchial tree and pulmonary parenchyma and an intense inflammatory reaction.[48] Bronchitis is an inflammation of the bronchi that can occur as a result of aspiration or prolonged coughing in an attempt to clear an aspirated bolus. These pulmonary complications differ from aspiration pneumonia, in that aspiration pneumonia is associated with abnormal swallowing structure or physiology.

Malnutrition

Malnutrition is common among the elderly, and 16% of individuals with acute stroke are malnourished on admission to hospital.[50] Estimates indicate that malnutrition either develops or worsens in 25% to 40% of stroke survivors, because of the development of a hypermetabolic state and because of feeding difficulties, such as dysphagia, necessitating NPO status, modified diets or an inability to eat sufficient quantities to meet nutritional needs. Up to 50% of stroke survivors admitted to rehabilitation from acute care may be malnourished.[5,51] A registered dietitian (RD) can assess clinical indicators of malnutrition, such as weight loss, decreased body mass index and evaluation of biochemical indices.[5]

Dehydration

Dehydration is a water and electrolyte disturbance resulting from either water loss or depletion of sodium with accompanying water loss. Dehydration can develop when metabolic water needs and losses exceed intake, such as occur with vomiting and diarrhea.[52,53] As elderly individuals may have a decreased sense of thirst, dehydration becomes more common with age. Almost 25% of individuals over 70 years of age are dehydrated on admission to hospital, and more than 33% of nursing home residents admitted to hospital are dehydrated.[51] Risk factors for dehydration in older adults include dementia, reduced mobility, dependency on others for oral intake and dysphagia.

Dysphagia is a risk factor for dehydration because it is associated with an inability to manage liquids safely, impaired cognition, dependency on others for oral intake and intolerance of thickened fluids with consequent voluntary restriction of fluid intake.[54,55] Dehydration is an important predisposing factor in stroke reoccurrence.[51,56] Signs of dehydration include the following:

- Confusion
- Dry mouth and tongue
- Sunken eyes
- Dry loose skin (decreased skin turgor)
- Decreased urine output.

Dysphagia Risk Factors

Stroke Location

Cerebral hemisphere stroke can affect motor and sensory responses of the swallowing mechanism. A left hemisphere stroke may also affect the stroke survivor's ability to understand or use language, produce clear speech or effectively communicate information. It may affect the right side of the face, lips and tongue, resulting in asymmetry, weakness and slow uncoordinated movement. A right hemisphere stroke may affect the left side of the face and reduce the ability to recognize and appreciate the extent of swallowing impairment.

The brainstem, the origin of most cranial nerves, is the main control for especially the pharyngeal stage of swallowing. Survivors of a brainstem stroke may or may not have any apparent weakness on either side of the face, mouth or throat, but they may have significant difficulties beginning or executing the pharyngeal stage of swallowing.

Comorbid Conditions

Comorbid conditions are physical or mental conditions that an individual developed before, during or after a stroke. Comorbidities may be present at birth or acquired during the course of maturation. Numerous conditions increase the risk of dysphagia, but not all individuals with these conditions have swallowing difficulties. When an individual with one or more relevant comorbid conditions experiences a stroke, the risk for dysphagia increases significantly.[39,47] It is therefore important to obtain a full medical history to identify comorbid conditions, the date of onset and relation to swallowing history.[20,31] The following comorbid conditions increase the risk of dysphagia:

Progressive neurologic conditions[27]

- Parkinson's disease
- Multiple sclerosis
- Huntington's chorea
- Amyotrophic lateral sclerosis (ALS)
- Advanced dementia

Neuromuscular disorders[27]

- Myasthenia gravis
- Polio and post-polio syndrome.
- Brain injury

Respiratory disorders[39,46]

- Asthma
- COPD

Systemic diseases[39,46]

- Arthritis
- Diabetes mellitus
- Epilepsy
- Gastrointestinal reflux disease (GERD)
- Thyroid conditions

Connective tissue diseases[57]

- Rheumatoid Arthritis
- Systemic lupus erythematosus (SLE)
- Scleroderma

Cancer and its treatment[58]

- Ablation of oral, pharyngeal or esophageal structures
- Radiotherapy to oral, pharyngeal or esophageal areas

Structural deficits[59,60]

- Zenker diverticulum
- Achalasia
- Degeneration of cervical spine.

Medications

Medications can contribute to or cause dysphagia by affecting fine motor function or by altering alertness or cognition.[27,61,62,104] Individuals weakened by stroke, dehydration, malnutrition or comorbid conditions may be more susceptible to the effects of medications. Medications may contribute to dysphagia in the following ways:[31,63]

Side effects:

- Autonomic nervous system side effects can occur with psychotropic agents associated with tardive dyskinesia or with neuropharmacology agents whose actions mimic neurotransmitters involved in swallowing muscle function
- Side effects can increase the risk of dysphagia: this can occur with agents that decrease salivation, causing xerostomia; those that increase salivation, cause mouth ulcers or are associated with gastrointestinal reflux.

Inability to take the medication due to dysphagia:

- This can occur with individuals with neuromuscular problems, such as Parkinson's disease
- This can occur with medications that cannot be administered in the appropriate form, such as sustained-release or liquid formulation.

Tracheotomy and Ventilation

Stroke survivors frequently experience respiratory problems, which vary depending on the site and severity of the stroke. Stroke can alter breathing patterns and reduce breath control enough that tracheotomy and/or mechanical ventilation may be required. The presence of a tracheotomy may impair swallowing function. For example, a tracheotomy insitu can increase the incidence and severity of aspiration.[65] Although many individuals with a tracheotomy continue to eat, their increased risk for dysphagia necessitates an assessment of the swallow by a speech-language pathologist.

Review Questions:

1. How many stages does the normal swallow have? Give one anatomic and one physiologic landmark for each stage.
2. Name 3 changes that occur to the swallowing mechanism due to normal aging.
3. What is dysphagia?
4. List the 3 most accurate clinical signs of aspiration.
5. Name 3 comorbid or pre-existing medical conditions with an increased risk of dysphagia.
6. Describe how medications can contribute to dysphagia.

Clinical Approach to Dysphagia

The clinical approach to dysphagia in stroke survivors involves initial screening, assessment, ongoing monitoring and management (Figure 6). Screening identifies the likelihood of dysphagia, but does not indicate the severity, whereas assessment identifies specific structural and physiological deficits and determines their severity. Nutritional screening is also performed, and individuals at risk of developing nutritional problems, especially if dysphagia screening is also positive, are fully assessed. Ongoing dysphagia monitoring involves regular observation of stroke survivors for clinical indicators that may indicate the development of dysphagia or changes in its severity. Management includes implementation of all strategies required to prevent complications of dysphagia, including oral hygiene, appropriate dietary modifications, and safe feeding strategies. An interdisciplinary dysphagia team implements this approach according to the specific needs of the stroke survivor as determined by a complete assessment administered by a SLP dysphagia expert.

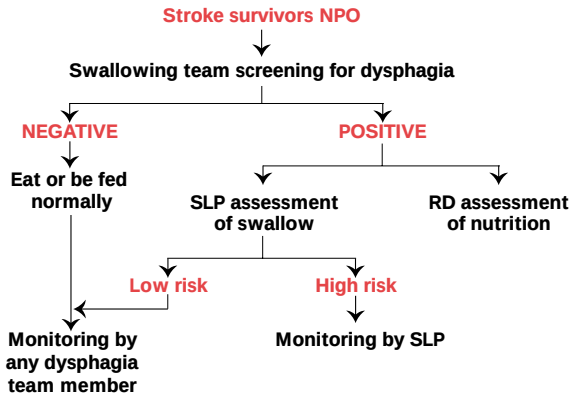

Figure 6.
Clinical approach to screening, assessing and monitoring stroke survivors for dysphagia

*Low risk and high risk refer to an individual's risk of developing dysphagia complications. This risk is determined by the SLP dysphagia expert as part of a full dysphagia assessment.

Adapted from Heart and Stroke Foundation of Ontario.[12]

Interdisciplinary Dysphagia Team

The interdisciplinary dysphagia team includes an SLP, RD, MD, RN, RPN, OT and/or PT, along with the stroke survivor, family and/or care providers. The team may also include a pharmacist, respiratory therapist or other individuals as appropriate. Each member of the team plays an essential role in identifying the risk of dysphagia, preventing complications and rehabilitating the stroke survivor with dysphagia.

Speech-Language Pathologist

The Speech-Language Pathologist (SLP) plays a central role in screening, assessing, treating and managing the stroke survivor with dysphagia. The College of Audiologists and Speech-Language Pathologists of Ontario (CASLPO) and the Canadian Association of Speech-Language Pathologists and Audiologists (CASLPA) have developed professional practice guideline that identify assessment and treatment of dysphagia as within the scope of practice of the SLP.[67,68] The SLP is also a resource to the dysphagia team, stroke survivors and the community. In the acute care setting, the SLP is often responsible for establishing and maintaining a system by which health care professionals can accurately and efficiently identify stroke survivors with an increased risk for dysphagia.

> *"A screening serves to identify patients at risk for dysphagia and initiate early referral for assessment, management or treatment for the purpose of preventing distressful dysphagia symptoms and minimizing risks to health."* [67]

The SLP is further responsible for assessing and developing a treatment and/or management plan

for each stroke survivor presenting with dysphagia. The intervention must be customized to the specific swallowing impairment of each individual.

> *"The scope of practice includes screening, identification, assessment, interpretation, diagnosis, management and rehabilitation of disorders of the upper aerodigestive tract, including swallowing."* [68]

Specifically, the SLP has the following role in addressing dysphagia among stroke survivors:[67]

- Develop, educate and mentor dysphagia teams
- Conduct a clinical assessment in all stroke survivors with a positive dysphagia screen
- Recommend and administer an instrumental assessment of dysphagia
- Generate a report interpreting clinical and/or instrumental assessments
- Recommend remedial programming to the physician and dysphagia team
- Provide swallowing treatment and/or management to stroke survivors, care providers and the dysphagia team
- Recommend an appropriate diet progression in consultation with other team members, ie., RD.
- Provide recommendations, information and education for families, care providers, staff members and stroke survivors.

Registered Dietitian

The Registered Dietitian (RD) plays a key role in assessing and monitoring clinical indicators of nutritional status, which may include evaluation of biochemical indices, body weight, fluid and solid intake, and route of nutrition administration (oral, enteral or parenteral). The RD also recommends types and route of administration of enteral feeding and dietary components, in an appropriate combination to maintain or achieve adequate caloric (micro and macro nutrients) and fluid intake and with the textures prescribed by the SLP dysphagia expert to achieve safe swallowing. Most often, the RD works closely with the SLP to monitor the stroke survivor and treatment and management strategies, and modify the management strategy appropriately.[20,31] The *Dysphagia Assessment and Treatment Network* of Dietitians of Canada has published a discussion paper on the role of the RD in dysphagia.[106] A College of Dietitians of Ontario Dysphagia Working Group has been struck to study the issues related to dietetic practice and dysphagia and is expected to report in early 2006.

Physician

The MD supervises the medical management of the stroke survivor, monitoring and managing pulmonary status and hydration, ordering appropriate investigations, consulting with the RD and SLP about the need for enteral or parenteral feeding, and reviewing dysphagia team recommendations with the family as required. [20,31]

Registered Nurse and Registered Practical Nurse

The Registered Nurse (RN) and Registered Practical Nurse (RPN) are key members of the dysphagia team based on the central role of this discipline in patient care, which involves monitoring acute stroke survivors at all times.[69] As a result, the RN or RPN is usually the individual providing screening when an institution implements universal dysphagia screening for acute stroke survivors.[70,71] Optimally, to reduce accidental aspiration, screening should be performed immediately upon admission, or as soon as the patient is alert, and before any oral intake is

allowed. The use of a systematic screening approach or a standardized protocol is ideal, as this increases the accurate detection of dysphagia and provides better protection for the stroke survivor.[72]

Occupational Therapist

The Occupational Therapist (OT) is traditionally responsible for activities of daily living, including meal preparation and pre-feeding activities. The OT determines the types of adaptive equipment needed and ways to improve meal set-up and food transport to the mouth. Expertise in this discipline includes teaching stroke survivors with motor deficits to adapt to new feeding techniques and recommending adaptive feeding equipment and upper extremity positioning to assist with feeding. [20,31]

Physiotherapist

The Physiotherapist (PT) can assist with optimal positioning, such as bed and wheelchair positioning, for safe feeding, and with implementing swallowing strategies that direct the bolus away from the airway and facilitate safer swallowing.[21]

Stroke Survivor, Family and Care Providers

The stroke survivor, family and care providers are integral to the dysphagia team. These individuals all require support and education about dysphagia and its safe management both during hospitalization and after discharge from acute care. The acute stroke survivor can be discharged to home, a rehabilitation facility or long-term care.

Dysphagia education is best provided throughout the continuum but typically begins in acute care and continues through to discharge to ensure smooth transitions to different stages and levels of care. It is critical that the stroke survivor and family receive sufficient information about appropriate management and the potential outcomes of noncompliance to help them make informed decisions, especially about diet and nutritional issues. It is important to remember that stroke survivors and their families may choose to follow idiosyncratic dietary choices rather than team recommendations. Stroke survivors have the right to refuse intervention, but they must be informed of the possible consequences of their decisions, and both the education and refusal should be well documented.[12,67,73]

Dysphagia Screening

The dysphagia team is responsible for screening the stroke survivor for signs and symptoms that may suggest an increased risk of dysphagia. Regulated health professionals, such as RNs, RDs, RPNs, OTs or PTs, can be trained to screen for dysphagia. However, the SLP dysphagia expert remains responsible for program development, referral criteria and professional education.[67]

Screening helps to identify the presence or absence of dysphagia and the risk of pulmonary, hydration or nutrition complications that may exist with the individual's current diet. However, screening does not provide information about pathophysiologic changes to the swallowing mechanism, which is determined by the SLP dysphagia expert during assessment. Screening may include an interview with the stroke survivor and family members about swallowing difficulties; a review of relevant medical history; direct observation of signs and symptoms of swallowing difficulties during routine or planned oral feeding, including a water swallowing test; and education and counselling about the need for further evaluation.

Screening should include a fast, safe and efficient test for identifying individuals with a high risk of dysphagia. In addition, screening should determine the stroke survivor's tolerance for evaluation and indicate changes in swallowing status during rehabilitation. A good screening test has the following attributes:

- Fast and easy to understand and use
- Acceptable to the stroke survivor
- Sensitive enough to provide a positive or negative result
- Specific enough to rule out individuals without risk of swallowing difficulty.

All stroke survivors should be screened for dysphagia as soon as they are awake and alert and before any oral intake is allowed, including oral medications and ice chips. Stroke survivors are to remain NPO until after screening, but good oral hygiene measures should be implemented to prevent colonization of the oral cavity by pathogenic bacteria.[12]

Stroke survivors with a negative screening (pass) are unlikely to have difficulties with oral intake and may receive a regular diet. These individuals should be monitored during their first few meals to ensure safe and efficient swallowing.

Stroke survivors with a positive screening (fail) are referred to the SLP dysphagia expert for a full assessment. The individual should remain NPO until after a full clinical bedside assessment, which should be completed within 24 hours of screening. During this time, good oral hygiene practices are to be continued at the bedside.

Toronto Bedside Swallowing Screening Test (TOR-BSST)©

Several screening tools for swallowing difficulties have been evaluated. Most screening tools share common features, but some screening procedures are better predictors of dysphagia than others. The *Toronto Bedside Swallowing Screening Test* (TOR-BSST©) is the only screening tool that has been developed from a systematic review of the literature.[2,74] Therefore, although the TOR-BSST© is still being evaluated, it appears to offer the greatest value, as it is based on the best available evidence.[75] The TOR-BSST© is a brief initial test that can accurately and reliably detect the presence of dysphagia, defined as the presence of aspiration or any physiological abnormality, in stroke patients, regardless of time post stroke. Any health care professional trainedto administer the TOR-BSST© to individuals with acute

stroke and interpret the results can use this dysphagia screening tool. The TOR-BSST© comprises 5 clinical tests (50-ml water test, impaired pharyngeal sensation, impaired tongue movements, dysphonia and general muscle weakness), which together have the highest likelihood of predicting dysphagia. Evaluation of the TOR-BSST© tool will be completed in the Winter of 2006, and the final version of the form will be incorporated following data analysis.

Dysphagia Assessment

Assessment extends beyond the basic risk identified in the screen to determine the exact site of structural or physical involvement and the degree of impairment. The SLP dysphagia expert may use a variety of clinical and instrumental methods to assess the swallowing mechanism.

Clinical Bedside Assessment

A clinical bedside assessment includes a complete medical, developmental and swallowing history along with evaluation of the current medical, swallowing and communication status. Clinical assessment evaluates swallowing structure and function to determine the overall nature and cause of impaired oral swallowing physiology, it determines the severity of oral dysphagia and provides details about oral swallowing pathophysiology, and it predicts impairment of pharyngeal and esophageal swallowing physiology. Potential risks of medical complications and the impact of the dysphagia on functional and psychosocial aspects of daily living, such as feeding safety and mode, are also identified. A clinical assessment includes follow-up recommendations for further assessment and for treatment and discharge. If warranted, the SLP or dysphagia expert recommends an instrumental assessment.[67]

Instrumental Assessment

Instrumental assessment determines impairment in the structure and function of swallowing and identifies compensatory and/or treatment strategies to enhance the efficacy and safety of swallowing. Instrumental assessment, which is performed only

after a clinical assessment, may include videofluoroscopy, ultrasound and endoscopy. [67]

Videofluoroscopy

The videofluoroscopy, also known as a modified barium swallow, is the most common instrumental procedure administered to individuals with dysphagia.[76] The videofluoroscopy is a radiologic procedure to study the anatomy and physiology of swallowing and define management and treatment strategies to improve swallowing safety or efficiency. The videofluoroscopy is also a valuable educational resource to demonstrate to the stroke survivor and caregivers the importance of compensatory strategies in improving swallowing safety.

Ultrasound

Ultrasound is an imaging modality that uses sound waves to create images of soft tissue structures inside the body. To assess swallowing, the individual with suspected dysphagia is placed in a sitting position, and a transducer, a device that transmits and receives sound waves, is placed under the chin to visualize tongue movements during swallowing.

Endoscopy

Fibre optic endoscopic evaluation of swallowing (FEES) uses a small fiberoptic camera placed in the nasopharynx or oral cavity to assess vocal fold function, especially closure, which protects the lungs from aspiration.

Nutrition Screening and Assessment

A trained interdisciplinary dysphagia team member performs a nutrition screening within 48 hours of admission. Stroke survivors with a positive nutrition screening (fail) are referred to an RD who assesses energy, protein and fluid needs, recommends dietary changes to meet these needs and implements alterations in food texture and fluid consistency, based on the dysphagia assessment.

Detailed information about nutrition screening can be found in *Management of Dysphagia in Acute Stroke: Nutrition Screening for Stroke Survivors*, an educational manual developed by the Heart and Stroke Foundation of Ontario to accompany this manual.

Ongoing Monitoring

Regular and careful monitoring of stroke survivors for dysphagia is critical. A stroke survivor's physical status can fluctuate on an hourly basis, directly affecting the ability to manage food and drink safely. The dysphagia team must be observant enough to identify subtle changes and the potential impact of these changes on the safety of oral intake.

The dysphagia team must monitor the stroke survivor's level of consciousness and alertness, especially since the oral stage of swallowing involves voluntary and planned movement. Swallowing frequency is greatly reduced during sleep, and swallowing does not occur during unconsciousness. As a result, the stroke survivor with a reduced level of consciousness or alertness has an increased risk of aspiration from saliva or food residue moving into the pharynx where it cannot be controlled voluntarily.

The team also monitors stroke survivors without initial signs or symptoms of dysphagia for the clinical indicators of potential dysphagia. Dysphagia may develop with changes in physical status, and swallowing abilities may deteriorate in stroke survivors already diagnosed with dysphagia. All changes in an individual's status should be discussed with the dysphagia team and, if necessary, the dysphagia expert should reassess the individual.

Feeding strategies should be reviewed regularly for stroke survivors receiving modified diets or enteral feeding, especially during the first weeks after the stroke, as swallowing function often changes during this time. Also, stroke survivors who remain on modified diets should be reassessed at minimum intervals of two to three months during the first year after the stroke, and every six months after that time.[12]

Clinical Indicators of Possible Dysphagia

Numerous clinical indicators can alert health care professionals to potential dysphagia. Some clinical indicators are readily apparent, whereas others can only be identified through careful observation or screening. Finally, some indicators can only be determined through a clinical or instrumental dysphagia assessment by a dysphagia expert. The likelihood of dysphagia increases with the presence of multiple indicators. Overall health and strength, the current level of alertness or consciousness and the presence of comorbid conditions strongly influence the way that dysphagia affects an individual's ability to manage oral intake safely. Any of the following clinical indicators can signify dysphagia:

- Missing or no teeth, or loose and poorly fitting dentures
- Dental caries and/or poor oral hygiene
- Drooling – poor lip closure or reduced ability to seal lips firmly
- Asymmetric facial and lip weakness
- Changes in voice – hoarse, gurgly or wet sounding
- Dysarthria – slowed, slurred and/or imprecise speech
- Inability to move tongue in all planes – reduced lateral and elevated movement
- Inability to chew foods or excessive chewing required to form a bolus
- Multiple swallows to clear a single bite of food
- Difficulty initiating a swallow, slow or delayed swallow
- Nasal regurgitation – food or liquid coming from nose
- Pocketing of food in mouth
- Coughing or choking during or after eating
- Shortness of breath and/or breathing difficulties that increase during the meal
- Xerostomia – dry mouth
- Audible or effortful swallowing – gulping with swallow
- Feeling of food sticking in throat or chest
- Unexplained weight loss
- Change in dietary habits
- Recurrent respiratory infections, specifically pneumonia
- Report or history of dysphagia signs and symptoms.

Dysphagia Management

Individualized dysphagia management is based on history, findings of the clinical and instrumental assessment, and prognosis. The objectives of managing dysphagia are to protect the airway from obstruction, reduce the chance of food or drink entering the lungs, ensure adequate nutrition and hydration, and maintain quality of life. The primary areas of intervention in managing dysphagia are the following:

- Oral hygiene
- Restriction of diet textures
- Feeding strategies
- Therapeutic and postural interventions
- Ongoing education and counselling.

Dysphagia must be managed effectively, as the negative impact of dysphagia on nutrition and hydration can negate the benefit of other interventions. A compromised physical status resulting from malnutrition and dehydration can lead to a suboptimal rehabilitation process, affecting both the duration and completeness of recovery. Timely and coordinated care for the individual with dysphagia is best provided by an interdisciplinary dysphagia team.[77] The SLP dysphagia expert develops an appropriate and comprehensive individual plan for each stroke survivor in whom dysphagia has been identified, incorporating interventions such as the following:[67]

- Modified diet texture
- Compensatory swallowing strategies
- Swallowing care plan to modify the environment and increase safety while swallowing
- Therapy or exercises to increase strength and coordination of swallowing muscles
- Consultation with physician and RD about alternative feeding options if oral intake is unsafe.

Oral Hygiene

Oral Health

A healthy mouth enables an individual to speak and socialize comfortably and contributes to general well-being. The healthy mouth is colonized by a variety of nonpathogenic bacteria bathed in saliva. Saliva production, which is stimulated by chewing, maintains a neutral oral pH, prevents dental caries, and flushes bacteria out of the mouth, thereby suppressing oral colonization by pathogenic bacteria and fungi.[78] Oral health depends on adequate fluid intake, nutrition, saliva production, oral hygiene and mastication ability.[79] The objectives of maintaining a healthy mouth are the following:[80]

- Clean, debris-free teeth and/or dentures
- Well-fitting dentures
- Healthy pink and moist oral mucosa, tongue and gums
- Moist smooth lips
- Adequate salivary production
- Reduced difficulties with swallowing or eating.

Oral health can change with age and illness. With age, teeth lose increasingly more soft tissue attachments and bone loss occurs, resulting in loose and brittle teeth.[79] Adoption of a softer diet can cause disuse atrophy of mastication muscles, and decreased chewing increases dental caries. Poorly fitting dentures make chewing difficult, negatively affecting oral intake, and they may also cause mouth ulcers and frictional keratoses. Poor dental hygiene and continuous wear of dentures can cause chronic atrophic candidiasis, which can develop into angular cheilitis or generalized oral candidiasis.

Several medical problems that can be seen in stroke survivors can also affect oral health.[81] Uremia associated with chronic renal failure can cause gingival bleeding; a red, dry, ulcerated oral mucosa; complaints of a salty,

metallic taste; and an ammoniacal breath odour. Diabetes can decrease mucosal circulation, resulting in poor healing of oral ulcers. Cancer and radiation therapy to the head and neck can depress immune function and decrease salivary production, resulting in oral candidiasis, mucositis, stomatitis, gingivitis, taste alterations, bleeding and worsened swallowing difficulties.

Dependence on others for oral care and dental caries are predictors of aspiration pneumonia, because of increased oral colonization by pathogenic bacteria and pulmonary microaspiration of these organisms.[47,82]

Impact of Stroke on Oral Health

Hospitalized survivors of acute stroke experience numerous sources of stress that can adversely affect oral health and oral hygiene. These stressors include medications that cause dry mouth, decreased alertness and cognitive changes, depression, paresis or paralysis resulting in immobility, reduced fluid intake, mouth breathing, intubation, and poor oral hygiene.[83] Poor oral hygiene negatively affects an individual's ability to chew, swallow and digest food, possibly leading to malnutrition and weight loss. Acute stroke survivors, who are dependent on others for oral hygiene, have an increased risk of oral health problems. Depression, which is common after acute stroke, may result in lack of attention to personal care, negatively affecting dental health. In addition, any loss of fine motor skills in the arms and hands, due to paresis, makes it more difficult for an individual to maintain good dental hygiene independently.

Poor oral hygiene can create a variety of problems. Xerostomia makes speaking difficult and painful and dentures difficult to wear. Decreased saliva production can cause swallowing difficulties, which can lead to reduced oral intake, adversely affecting health.[84] Halitosis, bad breath, may lead to social isolation. Oral infections can result from a variety of causes and lead to potentially serious systemic infections.

Oral plaque that is undisturbed for as little as three days provides an ideal environment for bacterial growth and can result in mucositis, xerostomia, stomatitis and gingivitis. Because the oral cavity is highly vascular, oral hygiene problems must be addressed promptly. Delays in treating oral infection can lead to tissue destruction at the gum line or at the tooth base, allowing bacteria to enter the bloodstream and resulting in a potentially serious systemic infection.[81]

The nurse is the primary caregiver for hospitalized acute stroke survivors. Several oral hygiene assessment tools for nursing are available and can be used to determine whether assistance is required and what strategies are appropriate in an individual situation. Appropriate oral hygiene assessment is an important component of care, as incomplete assessment may lead to inadequate oral care, negatively affecting health status.[80]

Oral Hygiene Approaches

The objective of oral hygiene is to maintain the mouth in a comfortable, clean, moist and infection-free state. Effective oral care requires cleaning the entire oral mucosa, the tongue, the teeth, and the sulci (spaces between the cheeks and gums) (Figure 7). Stroke survivors who have impaired oral sensation, and those who are unconscious, NPO, or eating and drinking

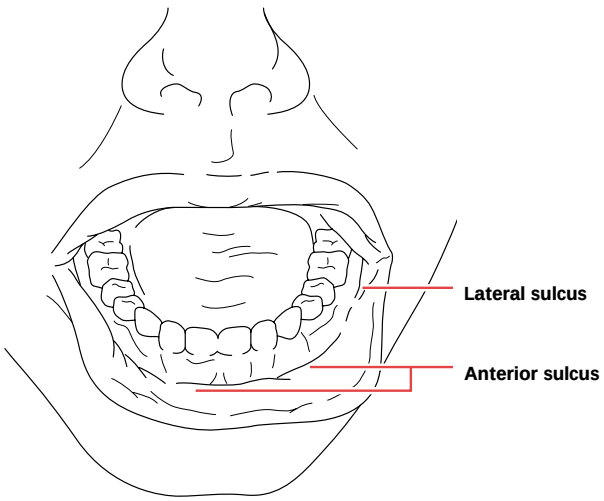

Figure 7.
Anterior and lateral sulci, or spaces between cheeks and gums

minimally, require thorough and effective oral care to maintain a healthy oral environment.[81]

Numerous oral hygiene approaches have been evaluated, with the following results:

- Foam swab: Foam swabs are ineffective in removing plaque, which accumulates in sheltered areas, such as between teeth.[85]
- Toothbrush: Soft or baby toothbrushes used appropriately are effective in removing dental plaque and minimizing mucosal injury.[85] Hard adult toothbrushes cause mucosal damage and gingival bleeding.[78,80]
- Gauze: Gauze, used with forceps, a tongue depressor or a finger is ineffective in cleaning teeth but beneficial in cleaning the oral cavity.[84]
- Lemon and glycerine: Lemon and glycerine stimulates saliva production initially, but this effect rapidly disappears, resulting in xerostomia. In addition, the acidity of the lemon can cause dental decalcification and oral irritation.[84]
- Sodium bicarbonate and hydrogen peroxide: These agents are effective in removing debris, but they have an unpleasant taste and have been associated with fungal overgrowth and inflammation.[78] In addition, concentrated solutions can burn the mucosa.[84]
- Toothpaste: Toothpaste loosens debris, and fluoride prevents dental caries. However, incomplete rinsing can increase xerostomia.[80]
- Mouthwash: Most mouthwashes contain alcohol, which can dry and irritate the mouth.[84]
- Water: Water is the best oral moistening agent.[84]

The following are the key implications for practice of these findings[80]

- Oral care approaches should be evidenced based
- Nurses should assist stroke survivors to maintain good oral care
- The equipment of choice should be a toothbrush
- Drug therapy can negatively affect oral health
- Baseline assessment of oral status can identify problems early.

Diet and Feeding

After completing a dysphagia assessment, the SLP dysphagia expert works with the dysphagia team to develop a comprehensive strategy to ensure that the stroke survivor can manage oral intake as safely as possible. Therapeutic dietary changes[107], a swallowing care plan, safe feeding strategies, and environmental considerations are all important aspects of this comprehensive approach.

Diet

Diet modification is one of the most frequently used interventions to compensate for dysphagia in hospitals and long-term care facilities. The American Speech and Hearing Association (ASHA) recognizes the need to standardize dysphagia diets using evidence-based research. The American Dietetic Association, in collaboration with speech-language pathologists, food scientists and industry representatives, has developed suggestions for standardized textures. However, these suggestions have not undergone formal testing and until such time are not approved by national professional associations. Variations exist across different clinical settings, but the following are the typical diet textures given to stroke survivors with dysphagia:

1. Mechanically chopped or minced semi-solids that require little chewing.
2. Pureed solids with homogeneous, very cohesive, pudding-like consistencies that require bolus control but no chewing.
3. Thickened, slower-moving liquids that compensate for slower-moving swallowing muscles.

A complete dysphagia assessment most often determines the appropriate dietary texture modifications.[12] These modifications, however, can reduce an individual's enjoyment of food, decreasing oral intake, which can lead rapidly to dehydration and eventually to malnu-

trition. Also, starch-based fluid thickeners increase carbohydrate intake, which may produce a nutritional imbalance if the diet is not carefully monitored. Controlling dietary carbohydrates is especially important in individuals with diabetes.

A consultation with an RD is critical to ensure that the modified diet is nutritionally adequate and appropriate. Consultation with the stroke survivor or substitute decision-maker ensures that the modified diet is as appealing as possible. It may be possible to manipulate the texture of some favourite foods to make them safe for dysphagic individuals. Examples of common foods that can meet texture modifications for individuals with dysphagia are the following:

- **Pureed foods:** Pureed foods are smooth and homogenous, with a spoon-thick consistency. This food texture includes mashed or blenderized foods with a dense, smooth consistency, such as yogurt, applesauce or mashed potatoes. Pureed foods should never be lumpy or runny.
- **Minced or ground foods:** This food texture refers to soft solid foods that have been chopped to pea-sized particles and are moist enough to form a cohesive and easy-to-chew bolus. A ground/minced diet allows the stroke survivor to eat with minimal chewing. Typical foods in this category include shepherd's pie and cottage cheese.
- **Thickened fluids:** The purpose of thickening liquids is to slow the time it takes for the fluid to move through the mouth and esophagus, allow better control of the swallow, and decrease the risk of aspiration pneumonia. The recommended thickness of thickened fluids varies, for example, from that of nectar to honey, and is determined individually. It is important to note that the thickness of a liquid is often temperature dependent; for example, ice cream is a puree when cold but a thin liquid at body temperature. Thickened fluids reduce the risk of aspiration, but stroke survivors often find them unappealing, increasing the risk of malnutrition and dehydration.

Certain food textures may be difficult for stroke survivors with dysphagia to manage. As a result, dysphagia diets may exclude the following:

- **Dry particulates:** Dry particulates can be difficult for individuals with dysphagia to form into a bolus and control in the mouth. Dry particulates include dry, crumbly cheeses; raw fruit and vegetables; cooked vegetables, such as corn and peas; rice and noodles; cookies, crackers, pastries and dry cakes; dry cereal and snacks; dried foods, such as raisins, nuts and seeds; hard candies; and peanut butter. Dry particulates, such as rice and corn, may be included in the diet if the preparation method moistens them and binds them together, for example, by incorporating them in puddings or casseroles.
- **Bread products:** Gummy bread products and foods made from these products can stick in the throat. This category includes fresh bread and rolls, muffins, cookies, cakes, pastries, toast, French toast, sandwiches and pancakes. In some situations, bread products can be moistened with sauces, butter, oil or cream, so that they form a relatively safe bolus. For example, adding liberal amounts of butter or margarine prevents fresh bread from sticking in the throat, and removing dry crusts facilitates swallowing. In this way, individuals with dysphagia can enjoy well-buttered crustless sandwiches with soft moist fillings, such as egg salad.
- **Mixed consistencies:** Foods that combine liquids and solids can be difficult for dysphagic individuals to control in the mouth, because they must first separate the different consistencies and then manage them separately. Foods with mixed consistency include canned fruit in syrup, cereal with milk, some soups, and pills given with water. However, fruit in syrup and soups can be pureed for the dysphagic individual.
- **Thin fluids:** Thin fluids might be difficult for dysphagic individuals to control, thereby allowing fluids to enter the pharynx prematurely and leak into the open airway. Thin fluids include water, juice, milk, tea, coffee, broth, creamed or strained soups, soft drinks, commercial supplements and cold or frozen food items that liquefy at body temperature, such as ice cream, ice cubes and gelatin.
- **Reflux-promoting foods:** Some food and liquids cause gastroesophageal reflux which can produce respiratory complications in some individuals with dysphagia. These foods include highly spiced and acidic foods, peppermint, spearmint, fried foods, coffee, tea, chocolate and cola.

Feeding

Swallowing Care Plan

A swallowing care plan is designed to increase safety, reduce fatigue, maintain adequate nutrition and hydration, and improve the stroke survivor's quality of life during the feeding process. A swallowing care plan addresses all aspects of therapeutic meal plans and safe swallowing strategies and has the following objectives:

- Reduce risk of aspiration, airway obstruction and pneumonia in stroke survivors
- Assist hospital staff on all shifts in caring for stroke survivors
- Increase feeding safety and efficiency by posting information at bedside.

The SLP dysphagia expert develops the swallowing care plan to meet the needs of the individual stroke survivor and modifies it as physical status changes. The swallowing care plan incorporates as many pictures or graphic instructions as possible to make it easy to interpret and implement.

Uniform implementation of a swallowing care plan by everyone providing feeding assistance to the stroke survivor – the dysphagia team, including family members, caregivers and others – is a critical aspect of managing dysphagia. Studies indicate that RNs who are not knowledgeable about patient feeding and regard it as a nuisance or outside their role description may not implement swallowing care plans. Lack of compliance may contribute to increased swallowing and feeding problems, thereby increasing the risk of aspiration pneumonia and other adverse sequelae.[47,72,86-88]

The structure and format of a swallowing care plan makes it easier for all persons who assist with feeding to refer to individual needs whenever necessary. The swallowing care plan includes the following specific information about the individual stroke survivor and environment:

Stroke survivor:

- Physical status: reduced tolerance for eating, as a result of weakness, nausea or loss of appetite
- Cognitive status: reduced alertness, orientation, cooperation
- Sensory deficits: deficits in vision, hearing, touch, taste or smell
- Assistance levels: level of feeding assistance or meal supervision required.

Environment:

- Distractions and deficits: High noise or activity levels, inadequate lighting, difficulty reaching food/liquid
- Environmental structures and restrictions.

Types of information:

- Positioning information
- Diet textures
- Adaptive equipment
- Special feeding techniques
- Communication strategies
- Recommendations for managing behaviours
- After-meal care.

Safe Feeding Practices

Family and other caregivers can assist in implementing safe feeding practices that help to maintain the stroke survivor's enjoyment of eating and quality of life. Safe feeding practices include observing the stroke survivor during feeding, encouraging strategies to improve eating behaviour to ensure adequate oral intake and effective feeding techniques, and using recommended medication administration methods.

Dysphagia team members, including family and the stroke survivor, must address behavioural problems or sensory issues, such as the following, that can interfere with effective eating:

- Use of incorrect utensils, preventing effective eating
- Performance of repetitive feeding movements, such as stabbing but not securing food, or stopping with utensil in midair, that prevent food/liquid intake and cause fatigue
- Serving very hot food/liquids that cause oral burns in individuals with loss of sensation
- Visual field neglect, which results in untouched food on one side of plate.

Strategies to improve oral intake include the following:

- Time medications so that the stroke survivor is pain-free at mealtimes
- Present high-protein, high-energy foods first if oral intake is low
- Socialize during meal to make eating more enjoyable.
- Ensure food/liquid is warm, and reheat it if necessary, as warm food/liquid is more palatable and increases sensory input and intake.

Effective feeding techniques include the following:

- Use a slow rate of presentation
- Allow adequate time between bites of food
- Control rate of intake by presenting a maximum of 1 teaspoon per bite
- Place food on the strong side of mouth
- Encourage the stroke survivor to take 2 or more swallows per bite, to clear residue and aid esophageal transit
- Alternate liquids and solids, but never combine them in the same bite
- Talk conversationally with stroke survivor during oral intake, but time responses so that the stroke survivor does not reply with food/liquid in mouth
- Advise stroke survivor of what food/liquid is being presented
- Ask stroke survivor in which order food/liquid should be presented
- Provide visual or verbal cues for opening mouth, chewing and swallowing
- Reduce or eliminate talking by the stroke survivor during oral intake, but allow talking between bites
- Check for pocketing and residue after feeding.

Most individuals with dysphagia must change the way they take their medications for safety reasons.[80] An SLP dysphagia expert determines the safest way to administer medications and consults with the pharmacist to ensure that the medication form can be changed (see Appendix). The SLP dysphagia expert may then make recommendations for taking medications to increase the safety of medication intake based on the stroke survivor's ability. Recommendations might include the following:

- Pills should be taken with water, one at a time
- Pills should be crushed (verify with pharmacist that pill is crushable)
- Pills should be cut in half (verify with pharmacist that pill can be cut)
- Medication should be given as a liquid, possibly thickened (verify with pharmacist that medication can be dispensed in liquid form and that it can be thickened using specific parameters)
- Pills should be placed in a spoon of puree, such as applesauce or pudding
- Pills should not be taken with water.

If dysphagia is more severe, the SLP dysphagia expert may recommend that the individual remain NPO for safety reasons. Using input about the swallowing prognosis from the SLP dysphagia expert, the physician and the RD determines the most appropriate NPO mode for the stroke survivor. Typically, either a nasogastric (NG) or percutaneous endoscopic gastrotomy (PEG) tube is selected. Tube feeding ensures proper nourishment and hydration, but tubes that are improperly cared for or managed can increase the risk of aspiration pneumonia. Specifically, tube displacement, improper tube removal or gastroesophageal reflux in stroke survivors who are improperly positioned during and after feeding may lead to pulmonary complications.[89]

Environment

The environment in which the dysphagic patient is eating is highly important for safe feeding. This includes the individual's physical status and environment, sensory input, the social aspect of meals and meal independence.

Physical Status and Environment

Safety and quality of life of the stroke survivor are primary considerations in managing the physical environment, especially adjusting lighting and temperature. The stroke survivor should be placed near a window or light source that provides adequate light to see the colour, texture and type of food/liquid. Lighting should be assessed at different times of day to minimize shadow, glare and inadequate lighting. Shades and blinds can reduce light and glare. Temperature extremes, such as drafts and hot spots, can cause discomfort or increase fatigue and should be avoided. Fatigue may result from the stroke, medications, stress or rehab therapy. Reducing fatigue is important to safety and health, as fatigue is associated with an increased risk of aspiration and a decreased ability to eat sufficient food/liquid to maintain nutritional requirements.[90]

Sensory Input

The senses – sight, hearing, smell, taste and touch – provide important information about the environment and increase eating safety and enjoyment. Therefore, adaptive devices that enhance sensory information should be in place before eating and drinking.

Dentures should be clean and conveniently located for the stroke survivor to insert before oral intake. Dentures and partial plates should fit properly. Denture adhesives can anchor dentures that have loosened because of oral changes as a result of the stroke.

Eyeglasses should be worn if needed to improve vision and depth perception and provide additional sensory input about food/liquid textures. Visual field deficits and neglect can create problems with eating, such as an inability to see food on part of the plate. In this situation, the SLP should work with the OT to ensure that appropriate instructions for managing visual problems are included in the swallowing care plan. The person providing feeding assistance should move the plate or the food to ensure that the stroke survivor can see and eat the entire meal.

Hearing aids should be clean and properly placed in the stroke survivor's ears, and batteries should be checked regularly.

Social Aspect of Meals

People generally associate eating and drinking with health and well-being. In addition, in most cultures, meals are important social events, and sharing meals with loved ones increases feelings of well-being. The decreased ability to eat and drink in social situations without coughing, choking or embarrassment contributes to depression in stroke survivors with dysphagia.[91] Therefore, it is important to reduce feelings of isolation during eating without introducing distractions or creating sensory overload. Talking during eating and

drinking, as well as distractions, such as radio and television, place the stroke survivor with dysphagia at increased risk of aspiration and choking.

Meal Independence

Meal independence is a primary objective for stroke survivors, as an increased dependency on others to provide feeding assistance is associated with an increased risk of aspiration, dehydration and malnutrition.[47] Many stroke survivors can feed themselves if the environment is adjusted to accommodate their physical impairments. The dysphagia team can maximize meal independence by ensuring appropriate positioning, equipment, and food/liquid preparation and presentation.

The PT can assess trunk control. The safest posture for eating is sitting upright at 90°, with the body at midline and the head and trunk aligned. Paresis, spasticity and impaired cervical stability can reduce the ability of the stroke survivor to maintain this posture. Cushions, bolsters and neck supports can stabilize the head, and help the stroke survivor maintain an upright position.

The OT can suggest trays, cups, plates, weighted or shaped utensils, and materials such as dicem, that prevent dishes from sliding. These strategies can solve problems with food/liquid access and spillage, and allow the stroke survivor to feed themselves.

The RD can recommend alterations in food/liquid preparation and presentation to increase safety and meal independence. Finger foods, sandwiches and firm foods, which can easily be managed with one hand or one utensil, increase meal independence for individuals with hemiparesis.

Education and Counselling

The need for better information about stroke and its impact on stroke survivors and families has been identified, and many Heart and Stroke Foundation of Ontario initiatives have addressed this need. However, stroke survivors and caregivers still report that they have not received any information about their illness, despite discussions with health care professionals and the provision of written information.[92] Up to 89% of stroke survivors are satisfied with their overall care, but only 50% are satisfied with the information received in hospital.

Information needs vary over time and circumstances, and may continue for several years after stroke.[93] Too much information too early may be detrimental to recovery.[92] Surveys conducted among individuals with a variety of conditions show that education can influence behavioural changes that lead to better health outcomes and reduce stress in decision making.[94] Stroke survivors and caregivers found that the most beneficial education met the following criteria:[92,93]

- Individualized and personalized
- Delivered at appropriate times during the recovery process: for example, providing information about feeding options to a stroke survivor who is NPO
- Provided in written form
- Supported by functional examples and implementation.

Education about dysphagia can take place at the bedside by example or demonstration. Information can be given verbally, but it is more effective when provided in written form as often as possible. Processing auditory information is reduced when people are under stress, distracted or dealing with unfamiliar information. For the stroke survivor and caregivers, terms and concepts important for understanding dysphagia may be unfamiliar and overwhelming when first presented. Stroke survivors

and caregivers may benefit from being made aware of the educational materials and approaches that are available to them, including the following:

- Brochures providing overviews of dysphagia information developed on site or obtained from standard sources
- Booklets providing stroke- and dysphagia-specific information available through support groups
- Support groups, through organizations such as the Heart and Stroke Foundation of Ontario
- Internet chat lines, special-interest Web pages and general topic information
- Libraries in hospitals.

The Continuum of Dysphagia Care

This manual has been developed for health care professionals working with stroke survivors with dysphagia in the acute care setting. Most of this information also applies to individuals in rehabilitation and chronic care settings with persistent dysphagia. In these settings, the main management difference is that dysphagia will have already been identified and an intervention plan implemented. Therefore, it is critical that all current information about swallowing status and the swallowing care plan is transferred to the receiving facility and dysphagia team.[67] An effective transition ensures continued successful management of the dysphagia and prevents consequences of unmanaged dysphagia, such as pulmonary, nutrition or hydration complications.

Review Questions

1. What 3 food/liquid textures might the dysphagia expert prescribe for a stroke patient with dysphagia?
2. Patients unable to eat by mouth are instead fed via a tube. Name one risk and one benefit of tube feeding.
3. Describe 3 purposes for a program of oral hygiene for patients with dysphagia.
4. Discuss the 1 risk and 1 benefit for giving a stroke survivor only thickened fluids.
5. What is the role of the SLP in the care of the stroke survivor with dysphagia?
6. What is the role of the RD in the care of the stroke survivor with dysphagia?
7. What is the difference in purpose between a screening tool and an assessment tool?
8. Name 4 members of the interdisciplinary dysphagia team and identify their roles.
9. What is the most common instrumental test for dysphagia and who typically administers it?

Dysphagia Case Studies

Case Study #1

RS is a 71-year-old male who was admitted to hospital with right-sided weakness and garbled speech. RS was accompanied to hospital by his wife of 50 years, and she provided medical and social histories. His medical history includes Parkinson's disease (1998), transurethral radical prostatectomy (1996) and appendectomy (remote). Mr. and Mrs. S have six children and 23 grandchildren, mostly living nearby. RS worked as an electrician for 40 years and recently worked as a clerk in the local farmers' supply store for 3 years until his Parkinson's symptoms became pronounced.

On admission, blood pressure was 166/78 mmHg, pulse was 82 bpm and SaO_2 was 92%. Right visual field neglect was identified, and right facial asymmetry and dense right-sided paresis in the arm and leg were present. Tremors were present on the left side. Unintelligible speech and drooling were noted. Mr. S was wearing glasses, a hearing aid in the right ear and dentures when he was admitted. A computed tomography (CT) scan performed in the emergency department demonstrated a lacunar infarct in the left periventricular white matter. Electrocardiography (ECG) showed atrial fibrillation. Chest radiography is pending.

For discussion

1. What are the most immediate concerns for this individual?

2. As a member of the interdisciplinary dysphagia team, what is your role?

3. Briefly describe how you should respond to the swallowing needs of this individual.

Case Study #2

DL is a 66-year-old male who presented in the emergency department after collapsing at home while digging in the garden. His wife found him unable to move his right arm or leg and unable to speak. A CT scan performed in the emergency department detected an early left middle cerebral artery (MCA) infarct. Echocardiography found a moderately enlarged left ventricle with grade II left ventricular systolic function but no clots and an elevated right ventricular systolic pressure of 88 mmHg. DL was obtunded, with no gag reflex, left deviation of the eyes, and intermittent consciousness.

DL had not seen a doctor in 15 years. Previously, he had been independent and in good health, with no history of hypertension, diabetes, hypercholesterolemia or hospitalization. He did not take any medications and had stopped smoking 18 years ago. DL lives with his wife and three children. Family members accompanied him to the hospital, and they are very anxious. DL has now been in the emergency department for two hours. His family members want him to be fed and given medication for pain, as they believe he is in pain.

For discussion

1. Based on the best practice guidelines for dysphagia, how will the dysphagia screening process take place for this individual? That is:

   a. Who will start the process?
   b. What will or will not be done?
   c. When will it occur?
   d. Where will it happen?

2. Think of the best ways to address the family's concerns.

Case Study #3

HN is an 85-year-old female who presented in the emergency department after a fall at home. She presents with left-sided weakness, decreased pain and temperature sensation, facial droop, slurred speech, dry mucous membranes, an intact gag reflex, cuts and abrasions and confusion.

Until the event, HN had been independent and lived alone. Previous medical history includes steroid-dependent rheumatoid arthritis, primarily affecting hands, knees and hips, atrial fibrillation and type 2 diabetes mellitus. Her family reports she has lost weight over the past six months, although she had not been dieting. In the emergency department, her daughter gave HN orange juice, as she thought her blood sugar may have been getting low. Her daughter reported that she began to sputter and choke when she attempted to swallow the juice.

A CT scan shows a right-hemisphere infarct. Chest radiography shows pneumonia in the right upper lobe. HN has been in the emergency department now for two hours.

For discussion

1. Based on the best practice guidelines for dysphagia, how will the dysphagia screening process take place for this individual? That is:

   a. Who will start the process?
   b. What will or will not be done?
   c. When will it occur?
   d. Where will it happen?

2. Think of the best way to address HN's diabetic medical status in light of current swallowing difficulties.

Appendix

Medications That Should Not Be Crushed

In general, enteric-coated and extended-release medications should not be crushed.[105] Specifically, the following medications should not be crushed:[95]

Adalat CC, XL, PA (nifedipine CC, XL, PA)
Arthrotec (diclofenac/misoprostol)
Asacol (5-aminosalicylic acid)
Bayer Aspirin (ASA enteric-coated)
Cardizem CD, SR (diltiazem CD, SR)
Cipro (ciprofloxacin)
Cronovera (verapamil)
Depakene (valproic acid)
Enteric-Coated Naproxen
Effexor XR (venlafaxine XR)
Flomax (tamsulosin)
Imdur (isosorbide-5-mononitrate)
Isoptin SR (verapamil)
Isosorbide dinitrate SR
Losec (omeprazole)
MS Contin (morphine slow release)
OxyContin (oxycodone slow release)
Pantoloc (pantoprazole)
Prevacid (lansoprazole)
Proscar (finasteride)
Prozac (fluoxetine)
Sinemet CR (levodopa/carbidopa SR)
Tegretol CR (carbamazepine)
Theo-Dur (theophylline SR)
Trental (pentoxifylline)
Uni-Dur (theophylline SR)
Uniphyl (theophylline SR)
Wellbutrin SR (bupropion)
Voltaren SR (diclofenac SR)
Zyban (bupropion).

Glossary

Achalasia: Failure of a ring of muscle, such as a sphincter, to relax. Achalasia occurring in the UES or LES can contribute to pharyngeal and/or esophageal dysphagia. The most common symptoms of achalasia are dysphagia, regurgitation and chest pain. Although initially dysphagia may be for solids only, as many as 70 to 97% of patients with esophageal achalasia have dysphagia for both solids and liquids at presentation.[18]

Apraxia: Motor programming deficit that can involve speech and the oral preparatory stage of swallowing but does not affect involuntary or automatic tasks.

Aspiration: Entry of food or liquid into the airway below the muscles that produce sound, that is, the vocal cords.[32]

Aspiration pneumonia: Respiratory tract infection resulting from inhalation of oropharyngeal secretions, food or drink.[96]

Assessment: Evaluation of the structural and physiologic details of a disorder and determination of the best intervention. Assessment of swallowing determines the overall nature and causal factors of impairment of oral swallowing stages and predicts impairment of pharyngeal, laryngeal and esophageal swallowing physiology. This is in contrast to screening (see definition below).[97]

Brainstem stroke: The brainstem controls basic physiologic functions. Signs of brainstem stroke include ataxia, impaired swallowing, coma or low-level consciousness, loss of balance, unstable blood pressure, double vision, bilateral paralysis, difficulty breathing, nausea and vomiting.[98]

Bolus: Accumulation of liquid or masticated solids held between the tongue and hard palate and then propelled posteriorly into the pharynx.[97]

Clinical bedside swallowing assessment: A bedside assessment is carried out by an SLP during evaluation of an individual's oral swallowing mechanism, vocal quality, productivity of cough, language and cognitive skills, self-feeding skills and level of endurance. The findings determine recommendations for further investigation, including instrumental assessment, management and education.[67]

Comorbid conditions: Comorbid conditions are any congenital or acquired, physical or mental conditions, present independently of the onset of another medical condition, determined by taking a history.

Dehydration: A water and electrolyte disturbance resulting from either water loss or depletion of sodium with accompanying water loss, which develops when metabolic water needs and losses exceed intake.[54]

Discharge planning: Process that directs interventions toward an ultimate goal of appropriate and timely discharge from current services or transfer to another setting.[67]

Dysarthria: A group of speech disorders resulting from disturbances of muscular control due to damage to the peripheral or central nervous system, or both. Dysarthria is characterized by weakness, slowness or lack of coordination of the speech mechanism.[99]

Dysphagia: A swallowing disorder associated with difficulty moving food/liquid from the mouth to the stomach.[20,31]

Dysphagia diets: Diets modified in physical properties, such as texture or viscosity, to meet the needs of an individual with dysphagia. Optimally, dysphagia diets are prescribed based on the results of a clinical and, possibly, an instrumental assessment to compensate for identified physiologic and/or structural swallowing abnormalities. Dysphagia diets are often prescribed in stages designed to gradually facilitate safe return to a regular diet.[97]

Dysphagia management: Intervention prescribed by a dysphagia expert to compensate for impaired swallowing structure and neurophysiology to optimize safety, efficiency and effectiveness of the oropharyngeal swallow, and maintain nutrition and hydration.[97]

Dysphagia team: A team with representation from different disciplines and/or specialties that acts together to screen and manage stroke survivors with swallowing and feeding disorders under the direction of a dysphagia expert.[12]

Enteral feeding: Administration of nutritional preparations into the digestive tract orally or through a tube, using gravity, pump-controlled infusion or a bolus with a syringe.[100]

Esophagus: A collapsed muscular tube, approximately 23 to 25 cm in length, with a sphincter or valve at each end: the UES at the top and the LES at the bottom. Proximally, the esophagus is directly below the pharynx and distally it attaches to the stomach.[18]

Faucial arches: Located bilaterally inside the oral cavity at the level of the tonsils along the sides of the throat.

Feeding: The act of transporting food/liquid toward the mouth in preparation for swallowing.[20]

Flexible fibre optic examination of swallowing (FEES): FEES is performed using a flexible scope inserted through the nose to the level of the soft palate or below to evaluate swallowing.[67]

Gingivitis: Inflammation of the gums with redness, swelling and bleeding; often associated with mouth breathing, poorly fitting dentures and vitamin deficiencies.[99]

Instrumental assessment: Various investigations, such as videofluoroscopy and FEES, which are adjunctive to clinical assessment. Instrumental assessment helps to determine impairment in the structure and function of oral, pharyngeal, laryngeal and upper esophageal swallowing physiology and identifies treatment or compensatory strategies that enhance the efficiency and safety of the swallow.[67]

Interdisciplinary dysphagia team: A team of health care professionals who work together collaboratively to screen, assess and manage dysphagia.[12]

Lower esophageal sphincter (LES): A muscular sphincter at the distal end of the esophagus that relaxes to open and constricts to close. The LES keeps food/liquid and digestive juices in the stomach and prevents reflux, or regurgitation, of food/liquid into the esophagus.[18]

Malnutrition: Unintentional loss of usual body weight, during a period of less than six months.[5]

Mucositis: Inflammation of the mucous membranes of the oral cavity that can cause pain, edema, ulceration and erythema.[99]

Nasal regurgitation: Leakage of food or drink into the nasopharynx before swallowing due to reduced contraction of the posterior tongue and/or the reduced elevation of the soft palate to appose the posterior nasopharyngeal wall.[21]

Nasogastric (NG) tube: The NG tube passes through the nose, pharynx and esophagus into the stomach. Liquid feed is passed through the NG tube for hydration and nutrition. The volume and number of feedings per day varies depending on the individual being fed and the setting. Having the person remain upright for one hour after feeding can minimize gastroesophageal reflux. A narrow tube reduces pharyngeal irritation.[102]

Oral cavity: The oral cavity includes the lips anteriorly, 24 deciduous and 32 permanent teeth, hard palate, soft palate (velum), uvula, lower jaw (mandible), tongue, floor of the mouth and the faucial arches.[21]

Oral intake: This term refers to food/liquid entering the mouth in preparation for swallowing. It includes meals, snacks, intake of medications, etc.

Oral transit time: The time for a bolus to travel through the oral cavity, beginning when the tongue starts to propel the bolus posteriorly and finishing when the bolus reaches the base of the tongue. [21]

Osteophytes: Bony outgrowths that can arise on the cervical vertebra and displace the posterior pharyngeal wall anteriorly. Surgical intervention may be considered if severe pharyngeal narrowing is present.[21]

Palate: Roof of the mouth, including the bony hard palate (the anterior two-thirds of the palate) and the muscular soft palate (the posterior one-third of the palate).[99]

Percutaneous endoscopic gastrostomy (PEG) tube: The PEG tube is a long-term method of feeding using liquid feed delivered through a tube inserted through the abdomen into the stomach. Insertion of a PEG tube is a reversible surgical procedure performed under local anesthesia.[103]

Pharyngeal transit time: The time for a bolus to travel through the pharynx, from the base of the tongue to the top of the esophagus. [21]

Pharyngeal webs: Webs that occur in the esophagus or the pharynx and are usually composed of normal mucosal folds.

Pneumonia: *see* Aspiration pneumonia

Pocketing: Food residue in the upper or lower sulci, between the gums and cheeks, or under the tongue after swallowing.[21]

Postural change: Adaptive swallowing technique incorporating changes in a client's body positioning to alter bolus flow through the oropharynx to increase swallowing safety and/or efficiency. Turning the head to the weaker side to redirect the bolus flow through the stronger side of the pharynx is an example of postural change.[31]

Presbyphagia: Changes to the swallowing mechanism due to the normal aging process.[25]

Risk indicators: Measurable characteristics or circumstances associated with increased likelihood of a poor status or outcome, such as impaired swallowing, malnutrition, poor health or death.

Screening: Procedure to identify individuals at risk of dysphagia and initiate earlier referral for assessment, management or treatment to prevent dysphagia complications and minimize health risks. This is in contrast to assessment, which evaluates the swallow in detail and provides information about severity and adequate intervention (see above).[67]

Silent aspiration: Passage of material below the level of the true vocal cords in the absence of cough or alteration in vocal quality.[32]

Swallowing apnea: Apnea, or cessation of breathing, occurring with airway closure during the pharyngeal stage of swallowing; duration of airway closure increases with bolus size.[64]

Swallowing strategy: Adaptive swallowing technique incorporating changes to a client's swallowing physiology, thus increasing swallowing safety and efficiency. The super-supraglottic swallow, a voluntary airway protection manoeuvre, is an example of a swallowing strategy.[67]

Swallowing treatment: Intervention intended to change swallowing physiology or the developmental swallowing pattern to improve the safety, efficiency and effectiveness of the oropharyngeal swallow and maintain nutrition and hydration. Procedures to improve laryngeal functioning and airway protection may also be involved.[67]

Tracheotomy: A surgical procedure by which an opening is made in the wall of the trachea into which a tube is inserted to facilitate breathing.[64]

Upper esophageal sphincter (UES): The UES is located at the proximal end of the esophagus. The UES opens to allow the bolus to pass into the esophagus and closes to prevent food and drink from refluxing from the esophagus into the pharynx.[18]

Velum: The posterior one-third of the palate, also called the soft palate, terminating at the finger-like uvula in the midline.[99]

Ventilator: A machine that provides mechanical support for breathing and an appropriate mixture of gases for life support. Mechanical ventilation is used when spontaneous inhalation and exhalation are inadequate for effective respiration.[64]

Videofluoroscopic swallowing study: A videotaped or digitized fluoroscopic evaluation of oral, pharyngeal, laryngeal and upper esophageal swallowing physiology that incorporates compensatory or treatment strategies.[67]

Viscosity: A measure of the intrinsic ability of a fluid to resist shear force. Viscosity is quantified as the ratio of shear stress to shear rate or the rate of fluid deformation and is commonly referred to as texture.[100]

Vocal folds/cords: Two muscles within the larynx and positioned behind the thyroid laminia, primarily responsible for producing sound. During the swallow, they adduct to close off the airway and thereby help prevent aspiration of food or liquid. This is referred to as the period of swallow apnea.

Xerostomia: Oral dryness due to reduced salivary flow, which can occur due to dysphagia, mouth breathing, oral infection, radiation therapy, oxygen therapy, certain medications and salivary gland diseases.[31]

Zenker diverticulum: A pocket resulting from herniation of muscle in the area joining the lower pharynx and upper esophagus.[31]

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