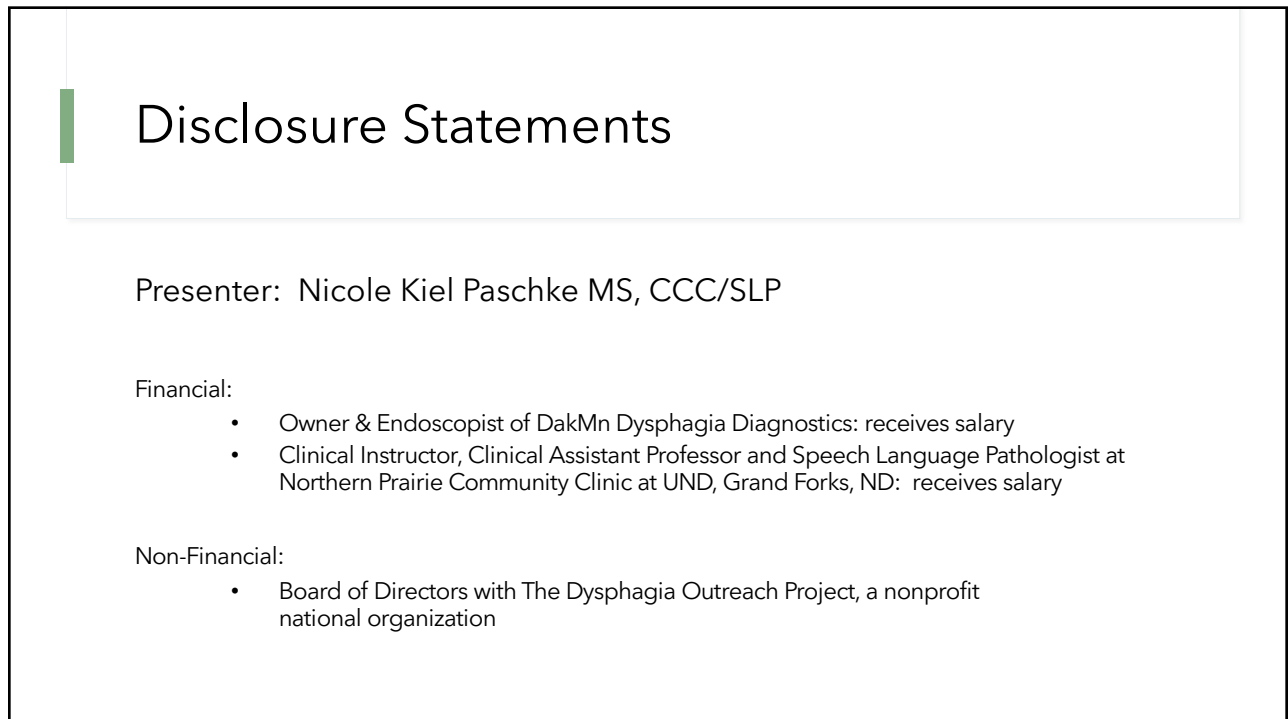


Dysphagia Following TBI & CVA

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Disclosure Statements

Presenter: Nicole Kiel Paschke MS, CCC/SLP

Financial:

- Owner & Endoscopist of DakMn Dysphagia Diagnostics: receives salary
- Clinical Instructor, Clinical Assistant Professor and Speech Language Pathologist at Northern Prairie Community Clinic at UND, Grand Forks, ND: receives salary

Non-Financial:

- Board of Directors with The Dysphagia Outreach Project, a nonprofit national organization

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Learner Objectives

After attending this presentation, the participant will be able to:

- Review basic dysphagia: oral, pharyngeal, esophageal phases
- Understand basic principles of IDDSI (International Dysphagia Diet Standardization Initiative)
- Review common scales / scoring of dysphagia
- Identify 3 causative factors of dysphagia with the TBI population.
- Understand the basic principles of the importance of oral cares and the *Three Pillars of Pneumonia* and *The Frazier Free Water Protocol*

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Incidence

- In the United States, around 1.7 million people are impacted TBI
- Older adolescents (ages 15 to 19 years) and older adults (ages 65 years and older) among the most likely to sustain a TBI.
- Frontal and temporal areas of the brain are the most common areas involved.
- Mild TBI (mTBI), also known as brain concussion, initially considered as a benign event, has galvanized tremendous attention for some of its adverse neuropsychological outcomes in civilians (e.g., athletes who play contact sports) as well as military personnel.
- Moderate to severe TBI is a primary cause of injury-induced death and disability.
- In the United States, It has an annual incidence of approximately 500 in 100,000. However, around 80% of all TBI cases are categorized as mild head injuries.

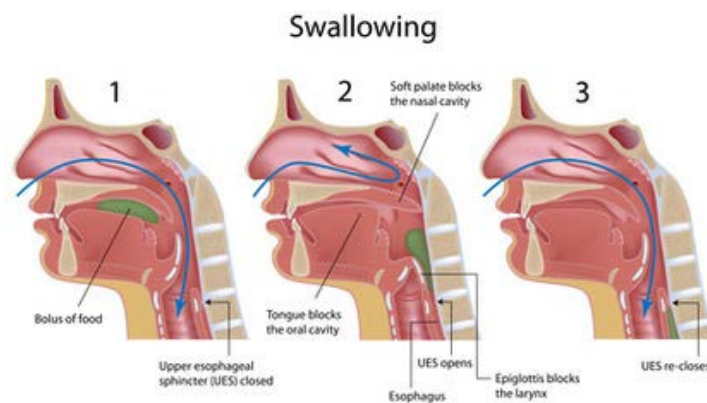
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Dysphagia (common terms)

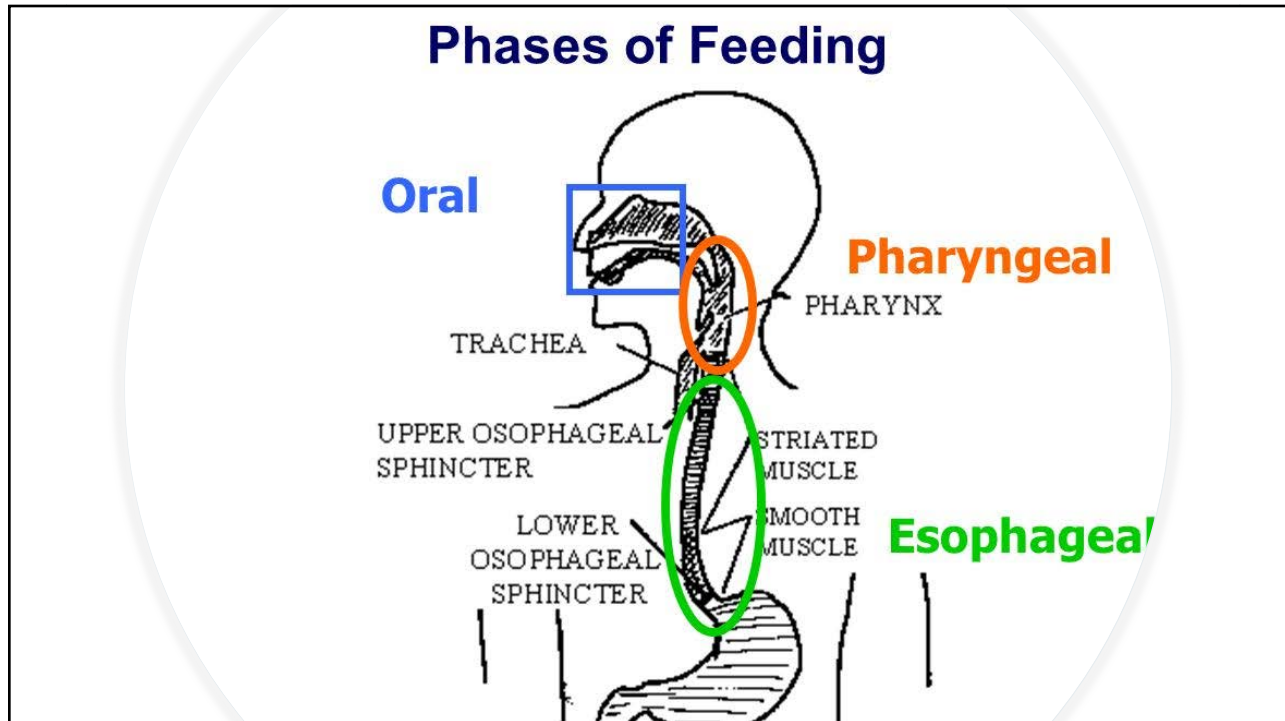
- Dysphagia: difficulty swallowing, can occur anywhere, from lips to gut
- Aspiration: material (food, drink or secretions that spill into the larynx (airway) and into the lungs.
- Pharyngeal residue: residue left following the swallow throughout the throat area, which can be aspirated following the swallow
- NPO: nothing by mouth
- Modified diet: thickened liquids or modified food textures to make the swallow more efficient and / or safe.

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Dysphagia: Three phases



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Three phases of the swallow

Oral Phase

- The food is manipulated (masticated if a solid) into a cohesive unit (referred to as a bolus) in preparation for the remaining phases of the swallow.
 - Food is chewed and mixed with saliva to form a bolus
 - Bolus is positioned on the tongue for transport

Pharyngeal Phase

- The "throat" portion of the swallow, movement through the pharynx into the esophagus. Protection of the airway occurs during this phase.

Esophageal Phase

- Movement of the bolus from the UES (upper esophageal sphincter) to the gut

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Normal Swallow: Safe & Efficient



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Dysphagia: Not safe (aspiration) & Not Efficient (residue)



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TBI and CVA Demographics

TBI

Demographics:

- Older adolescents (15-19) & older adults 65 and older.
- From 2006 to 2014, the number of TBI-related emergency department visits, hospitalizations, and deaths increased by 53%.
- In 2014, an average of 155 people in the United States died each day from injuries that include a TBI.
- Those who survive a TBI can face effects that last a few days, or the rest of their lives.

CVA

Demographics:

- 34% of people hospitalized for stroke were less than 65 years old

Stroke Statistics by Race and Ethnicity

- Stroke is the fifth leading cause of death for Americans, but the risk of having a stroke varies with race and ethnicity.
- Risk of having a first stroke is nearly twice as high for blacks as for whites, and blacks have the highest rate of death due to stroke.
- Though stroke death rates have declined for decades among all race/ethnicities, Hispanics have seen an increase in death rates since 2013.

CDC

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TBI vs CVA Causative factors

TBI

- In 2014, falls were the leading cause of TBI. Falls accounted for almost half (48%) of all TBI-related emergency department visits. Falls disproportionately affect children and older adults:
- Being struck by or against an object was the second leading cause of TBI-related ED visits, accounting for about 17% in 2014. Over 1 in 4 (28%)
- Over 1 in 4 (28%) TBI-related ED visits in children less than 17 years of age or less were caused by being struck by or against an object.
- Falls and motor vehicle crashes were the first and second leading causes of all TBI-related hospitalizations (52% and 20%, respectively).
- Intentional self-harm was the first leading cause of TBI-related deaths (33%) in 2014.

CVA

Leading causes of a stroke

- High blood pressure
 - High cholesterol
 - Smoking
 - Obesity
 - Diabetes
- 1 in 3 US adults has at least one of these conditions or habits.

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TBI vs CVA Infarcts

TBI

- TBI-related damage can be confined to one area of the brain, known as a focal injury, or it can occur over a more widespread area, known as a diffuse injury
- Most common injury: frontal and temporal lobes
- Diffuse axonal injury (DAI) is one of the most common types of brain injuries. DAI refers to widespread damage to the brain's white matter

CVA

- About 87% of all strokes are ischemic strokes, in which blood flow to the brain is blocked.
- Brainstem
- Cerebral hemisphere
- Cerebellum
- Basal Ganglia
- Internal Capsule

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Early Aspiration Risk Factors

- Loss of consciousness causes inability to protect the airway.
- Many patients have full stomach at the time of injury.
- Patients intubated at the scene have a greater risk for early onset PNA (3-7 days post)
- Patients with early onset PNA have higher incidence of swallowing disorders as compared with late onset (68% vs 42%) [Mackay, 1999]

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Medical Factors that Impact Swallow

- Multiple surgeries
- Prolonged disuse of swallowing muscles
- Medications that impact / impair swallowing muscles
- Injured during emergent intubation
- Prolonged intubation & tracheostomy [Mackay, 1999]

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Efficacy and accuracy of treatment?

- There is sparse evidence demonstrating the efficacy of dysphagia management strategies and treatments in this population.
- Typically, subjects with dysphagia following TBI are placed into non-specific 'neurogenic' dysphagia subject groups, which include subjects with degenerative neurological diseases, neurological cancers, and cerebrovascular accident.
- However, dysphagia following TBI has a multifactorial presentation, with causative and contributory factors including cognitive communication, behavioral, neurological, and mechanical issues.
- As such, the management for dysphagia post-TBI must be multifactorial, team-based and involve the patients' families and care-givers.

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Management of dysphagia following TBI

- Dysphagia is a common complication following TBI, with an incidence as high as 93 % in patients admitted to brain injury rehabilitation [Hanson].
- Dysphagia following TBI can be multifactorial, but mainly occurs because of neurological impairment to any or all the three phases of swallowing (the oral preparatory, the oral and pharyngeal phases) and cognitive-communication and behavioral dysfunction [Winstein] [Terre] [Cherney].
- Depending on the severity, and neuroanatomical site/s of injury, the resulting dysphagia can range from mild to severe, often necessitating enteral feeding [Rowe]

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Incidence of dysphagia & TBI?

A Systematic Review of the Prevalence of Oropharyngeal Dysphagia in Stroke, Parkinson's Disease, Alzheimer's Disease, Head Injury, and Pneumonia
[Takizawa et al, 2016]

Two studies of traumatic brain injury met the inclusion criteria.

- One study used VFSS to diagnose dysphagia, finding dysphagia incidence of 30 % [Field].
- The second was a chart review study, which found that 27 % of patients had dysphagia; however, they did not describe clearly the methods used to diagnose dysphagia [Winstein].

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Complications

The complications from dysphagia are varied, costly and potentially fatal.

- Patients with TBI and dysphagia have longer average hospital admissions compared to those without dysphagia [Field]
- Risk of weight loss, malnutrition and dehydration [Logeman]
- Dysphagia is causally linked with an increased risk of aspiration pneumonia; the incidence of which can be as high as 12 % following severe TBI [Hansen].
- The social and psychological impacts of dysphagia can reduce patients' quality of life [Eckberg]
- Post-discharge from rehabilitation, patients with TBI can be 79 times more likely to die from aspiration pneumonia compared to the general population [Howle].

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Cognitive Communication & Behavioral issues

- Early TBI studies revealed that the most prevalent issue interfering with swallowing function was reduced cognition, followed by motor-control impairments [Winstein].
- In patients with normal or near normal swallowing physiology, these cognitive-communication and behavioral issues cause or worsen the dysphagia [Logeman].
- The strong relationship between cognition and safe oral feeding is reported frequently.
- For example, lower admission scores on the Ranchos Los Amigos (RLA) scale are a risk factor for dysphagia and that as cognitive function improves, so do functional oral feeding skills, [Terre] [Mackay].
- RLA scores represent the most significant independent predictor of the time to return to full oral feeding [Mackay].

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Behavioral Impairments & Dysphagia

- Disinterest in eating
- Reduced initiation of oral feeding and swallowing
- Extreme agitation can preclude oral intake
- Low tolerance / attention for meals
- Increased risk of aspiration during behavioral outbursts during meals
- Rapid eating / large bites / impulsivity may increase risk of aspiration or choking

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Cognitive Impairment Dysphagia

- 84% (26/31) of patients with cognitive impairment-related dysphagia required prolonged swallowing rehabilitation
- 10% were eventually discharged with a percutaneous gastrostomy tube.
- In contrast, 100% (113/113) of those with oropharyngeal dysphagia without neurocognitive impairment rapidly recovered their swallowing function. (Kwok et al., 2013)

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Cognitive Function & Dysphagia After Stroke

- Cognitive function is associated with the presence and severity of post-stroke dysphagia. Above all, visual attention and executive functions may have meaningful influence on the oral phase of swallowing in stroke patients with supratentorial lesions
 - The dysphagia group showed significantly lower scores in motor, balance, and ADL function than the non-dysphagia group
 - Parameters of oral phase, especially premature loss, were also significantly correlated with cognitive subtests, notably for visual attention and executive function
 - Overall, swallowing ability was significantly correlated with subsets of cognitive functions related to visual cues rather than functions requiring auditory attention or verbal memory function. [Jo SY 2017]

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Sensory Impairments & Dysphagia

The process of receiving sensory information and actively integrating these stimuli into meaningful units.

- Tactile (touch)
- Visual
- Auditory (listening)
- Gustatory (taste)
- Olfactory (smell)
- Kinesthetic (awareness of body in space).

Impairments

- Reduced recognition
 - Smell, taste, textures
- Reduced appetite
- Reduced desire to participate in feeding tasks
- Texture defensive

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Treatment Suggestions

OT: compensatory feeding strategies

- Consider tactile defensiveness
 - Metal vs plastic utensils
 - Hot vs cold foods
 - Hard vs soft foods
 - Savory vs bland vs spicy

Awareness of eating environment

- Overstimulation
 - Too many options can be overwhelming
 - Too loud
 - Too bright / lights
- Understimulation
 - Change in position bed vs chair
 - Lighting, sound

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Meal-Time Strategies That Target Cognitive Communication and Behavioral Issues

- Controlling stimuli and the meal-time environment is also important for patients with agitation and combativeness. Identification and minimization of triggers for verbal or physical outbursts can reduce the likelihood of an outburst occurring during meal-times [Cherney].
- Supervised meals with a caregiver who cues to the patient to other issues such as speaking with the mouth full, may be required [Cherney].
- Giving small amounts of food or one utensil at a time at a time, cueing to reduce the amount and rate of food intake and to put utensils and cups down between mouthfuls are strategies that may reduce impulsive grabbing and 'shoveling' of food. [Cherney]
- In patients with memory or higher-level cognitive deficits, written and visual cues can provide reminders of mealtime strategies (for example, "take small mouthfuls") [Cherney].
- Providing simplified, written instructions of a series of steps that a patient may have to learn, perform and recall is an effective way of assisting patients to learn new sequences of actions such as adjusting posture for safer swallowing [Logeman].

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Meal-Time Strategies That Target Cognitive Communication and Behavioral Issues

- In patients where oral feeding is contraindicated due to low responsiveness, sensory stimulation (tactile, olfactory, gustatory, auditory and visual) to has been suggested to improve patient responsivity [Cherney].
- More frequent, smaller meals may be recommended if alertness fluctuates during the day. This can also be a useful strategy for patients with limited attention spans [Logemann]
- Reducing environmental distractions can assist patients with deficits in divided or alternating attention [Cherney].
- Meals in a quiet room, with closed curtains, away from televisions, other people, noisy traffic and other visual/auditory distractions can help [Logemann].
- As attentional skills improve, distractors can be gradually re-introduced to the meal-time environment. This fosters real-world skills such as eating while performing other activities, such as having a conversation [Cherney]

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Strategies and Treatments Targeting Swallowing Physiology

Dysphagia management techniques targeting swallowing physiology are often divided into 'compensatory' and 'rehabilitation'/direct therapy strategies.

- Postural adjustments
- Compensatory Swallowing Maneuvers
- Increased sensory input
- Modifying the volume and speed of bolus
- Food consistency and fluid viscosity changes

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Myth: Everyone benefits from a Chin Tuck



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To chin tuck or not to chin tuck.....

- Given the chin tuck has relatively low effectiveness in preventing aspiration, it must be assessed on VFSS or FEES prior to recommendation.
- "While it is a simple physiological postural adjustment...for some patients. .it is not a task that can be simply performed but may require more physical strength, neuromotor control and cognitive skill than has been routinely appreciated." [Ashford]

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The effectiveness of CTM is related to the overall degree of dysphagia, the more severe the dysphagia, the less effective the maneuver. CTM should benefit dysphagic patients with pharyngeal delay time, reduced laryngeal elevation, and difficulties in swallowing liquids. [Saconata 2016]



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Assessments & Scales



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Clinical Bedside Evaluation:
Patient is seen clinically,
without instrumentation.

VFSS: Video fluoroscopic
Swallow Study

FEES: Fiberoptic
Endoscopic Evaluation of
Swallow



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VFSS vs FEES

Major clinical indications
to proceed with a VFSS:

1. Specific concerns for esophageal problems
2. Specific concerns for oral problems
3. Assess for specific oral, pharyngeal, and esophageal anatomical changes contributing to dysphagia (e.g., Zenker's diverticulum, fistula).

Major clinical indications to
proceed with a FEES:

1. Assess secretion management, integrity of the larynx, and surrounding structures
2. Need to assess fatigue or textures not viewable on VFSS
3. Assess for specific laryngeal and pharyngeal anatomical and sensory deficits contributing to dysphagia (e.g., paralysis, presence/absence of sensation)
4. Concurrent voice changes/dysphonia.
5. Pre- and/or post-op head and neck surgeries

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Correlation of Glasgow Coma Scale Scores and Dysphagia

TABLE 38-2
Glasgow Coma Scale

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:	Best response	15
	Comatose client	8 or less
	Totally unresponsive	3

Lower GCS at admission

- Patients with lower scores (more severe TBI) took approximately 2 x as long to initiate oral feeding.
- Lower score = greater risk of aspiration
- GCS 3-5 (severe) resulted in 2 x as many swallowing abnormalities as compared to GCS 6-8 on VFSS [Mackay]

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Correlation between Ranchos Los Amigos Levels and Dysphagia

Rancho Los Amigos Scale

Level I	No Response: Total Assistance
Level II	Generalized Response: Total Assistance
Level III	Localized Response: Total
Level IV	Confused/Agitated: Maximal Assistance
Level V	Confused, Inappropriate Non-Agitated: Maximal Assistance
Level VI	Confused, Appropriate: Moderate Assistance
Level VII	Automatic, Appropriate: Minimal Assistance for Daily Living Skills
Level VIII	Purposeful, Appropriate: Stand-By Assistance
Level IX	Purposeful, Appropriate: Stand-By Assistance on Request
Level X	Purposeful, Appropriate: Modified Independent

Lower RLA levels at admission

- Higher % of abnormal swallowing
- 2-2.5 x to achieve total oral feeding.
- Admitting scores of RLA level II had more than twice as many swallowing abnormalities than admitting RLA levels III-IV.
- RLA is the most independent predictor of days to achievement of total oral feeding [Mackay]

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QOL: Quality of Life

A simple definition of QOL is the satisfaction and well-being that an individual experiences on a daily basis .

- QOL is a multidimensional concept, individualized, and highly personal. Unique to each person's perception of his or her situation.
- Swallowing disorders have been shown to have a major impact on global QOL.
- Many activities that add quality to our lives are based around social activities that often include eating.
- Dysphagia creates difficulty eating or health risks.
- Modified diets or ANH may be required.
- Although most people with dysphagia can continue to eat something safely, the fear of eating or the effort involved may greatly reduce the pleasure of the activity.
- Embarrassment may change the places in which a person is willing to eat and limit social activities.
- Slowness and fatigue in eating may impact the effectiveness of eating.
- Diet changes or restrictions may decrease the satisfaction of eating

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SWAL-QOL

- The SWAL-QOL is an outcomes tool for measuring the impact of dysphagia on QOL that has documented validity and reliability. Initially used for HNC.
- The SWAL-QOL assesses the patient's perspectives and is the first tool specific to swallowing disorders.
- The SWAL-QOL is a 44 item tool that assesses 10 QOL concepts
- The items on the SWAL-QOL address desire for eating, dysphagia symptom frequency, mental health, social concerns related to swallowing problems, food selection, fear related to eating, and the burden of dysphagia.
- The instruments help to identify patients with oropharyngeal dysphagia and are sensitive to differences in severity level.

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FOIS: Functional Oral Intake Scale

Functional Oral Intake Scale: Used document change in functional oral intake of food and liquid in patients.

TUBE DEPENDENT (levels 1-3)

1 No oral intake

2 Tube dependent with minimal/inconsistent oral intake

3 Tube supplements with consistent oral intake

TOTAL ORAL INTAKE (levels 4-7)

4 Total oral intake of a single consistency

5 Total oral intake of multiple consistencies requiring special preparation

6 Total oral intake with no special preparation, but must avoid specific foods or liquid items

7 Total oral intake with no restrictions

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EAT-10

- The EAT-10 is the quickest quality of life measures for swallowing disorders.
- It is an excellent self-rating tool that can identify how a swallowing deficit can affect function and quality of life.
- The 10 questions can be given to the patient on the initial assessment, during treatment and at the end of treatment to track the patient's response to treatment. It needs to be noted that the EAT-10 is not a screening tool, as it assumes the dysphagia deficit already.
- The EAT-10 was found to predict aspiration risk in people with dysphagia. They found that an individual with an EAT-10 score of over 15 is 2.2 times more likely to aspirate. [Cheney, et al., 2015]

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Dysphagia Handicap Index

- It is general and not specific to one disorder or etiology.
- It is simple to read and understand.
- It covers the physical, functional, and emotional aspects of the swallowing disorder.
- 25 questions the patient rates on a scale of 1-7, normal to severe problem

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Predicting Return to Oral intake

- 93% of all patients had problems with functional oral intake at admission. Within 126 days of rehabilitation, 64% recovered to unrestricted dieting before discharge.
- GCS, RLAS, FIM and FOIS scores were found to predict time to recovery of functional oral intake.
 - RLAS I-II: 24% chance of returning to unrestricted diet
 - RLAS III or higher: 77% chance
 - GCS 3-8 took longer time to initiate diet

[Hansen, 2008]

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Importance of Oral Cares

- Scrape a cubic millimeter of your teeth in the morning before you brush your teeth, and you could collect up to 10 billion microorganisms (Sheffler, 2014a)
- Floating free or attached to surfaces as plaque, there are over 600 species of bacteria in the mouth (Keijser et al., 2008)
- Poor oral hygiene will cause dental plaque to form a dense bacterial biofilm that, if aspirated, can increase the likelihood of developing pneumonia
- "Findings by Alexander et al. and Saxton et al., as reported by Rowshani, Timmerman, and Van der Velden (2004), show that plaque recolonizes on tooth surfaces within 3 hours of cleaning and to original concentration levels in less than 24 hours in healthy persons. For individuals with periodontal disease, plaque may recolonize within 5 minutes of cleaning." - Ashford (2012)

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It is so simple, brush your teeth....

- A nurse training program on the benefits of toothbrushing over foam swabs resulted in a 50% reduction in vent-acquired pneumonia (Ross & Crumpler, 2005).
- For tube fed patients, Maeda & Akagi (2014) found that standard oral care given 2x/day resulted in a 40% decrease in hospitalizations. And pneumonia was twice as high in the group that had no oral care protocol as compared to those getting oral care.
- If you look at these findings together with the idea that the oral biofilm is FULL of bacteria that do NOT belong in the lungs, you may agree that basic TOOTHBRUSHING truly is an Oral Infection (Prevention) Protocol, and there should be one in place throughout all hospitals.

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The Frazier Free Water Protocol

- What is the Frazier Free Water Protocol?
 - The Frazier Free Water Protocol (FFWP) allows certain patients to have the option of consuming thin water as part of a specific protocol despite being identified as being at risk for aspirating thin liquids. (Gillman, Winkler, & Taylor, 2017; Panther, 2005; Panther, n.d.)
- Evidence Supporting Free Water:
 - In 2017, Gillman, Winkler, & Taylor published a systematic review of research related to the use of free water in inpatient rehabilitation and acute care facilities. Their meta-analysis of data from 215 inpatients in a rehab setting concluded that implementation of a free water protocol did not result in increased odds of lung complications (aspiration pneumonia), provided patients did not have degenerative decline and “reasonably intact” cognition.

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What’s So Special About Water?

- Researchers suspect that water is safer to aspirate than other fluids (including thickened liquids) for several reasons:
 - Pure water contains less pathogenic bacteria than other fluids
 - Small amounts of aspirated pure water can be absorbed into the bloodstream via the lungs’ aquaporins (permeable water conducting channels) without causing an infection
 - We also know that thickened liquids may lead to decreased fluid consumption and dehydration may result
 - Dehydration may lead to health complications such as chronic renal insufficiency, sepsis, impaired cognition, venous thromboembolism acutely post stroke, and even death
- Source(s): (Gillman, Winkler, & Taylor, 2017; Panther, 2005; Panther, n.d.)

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YOU GET WATER!

AND YOU GET WATER!

Please SLP's advocate for water, especially for your NPO patients

Normal

NPO Patient

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The Three Pillars of Pneumonia

Dr. John Ashford

- Compromised Immune System**
 - Related to various underlying diseases and conditions, including aging
- The Presence of Aspiration**
 - Identified using instrumental studies such as VFSS or FEES
- Poor Oral Health**
 - Biofilm of bacteria in plaque

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Pneumonia “Risk” Predictor

	Oral Health Status		Laryngeal Valve Integrity*		Immune System Status#		Predicted Outcome*#	JRA
1	Good	+	No Aspiration	+	Normal	=	No Pneumonia	
2	Poor	+	No Aspiration	+	Normal	=	No Pneumonia	
3	Poor	+	Aspiration	+	Normal	=	No Pneumonia	
4	Good	+	Aspiration	+	Normal	=	No Pneumonia	
5	Good	+	No Aspiration	+	Reduced	=	No Pneumonia	
6	Poor	+	No Aspiration	+	Reduced	=	No Pneumonia	
7	Good	+	Aspiration	+	Reduced	=	Low Risk of Pneumonia	
8	Poor	+	Aspiration	+	Reduced	=	High Risk of Pneumonia	

*Nakajoh et al., 2000

#Tobin & Grenik, 1984;
Shockley, 1995;
Terpenning et al., 2001



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Intubation

- In one of the largest retrospective series on dysphagia in the ICU setting, 446 critically ill patients (without tracheostomy) underwent swallowing evaluation after extubation (patients with pre-existing neuromuscular disease or a cerebrovascular accident were excluded; Macht et al., 2011).
- Dysphagia was present in 84% of patients classified as moderate or severe in 40% .
- In multivariate analysis, mechanical ventilation for greater than 7 days was independently associated with 2.84-fold increased odds of developing moderate to severe dysphagia
- Investigators also showed that more than 25% of patients’ swallowing deficits persisted to hospital discharge.
- Moreover, a diagnosis of moderate or severe dysphagia was a harbinger for an increased risk of re-intubation, pneumonia, longer hospital stay, reduced dietary intake, placement of feeding tubes, discharge to a nursing home, and death.

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Field Intubation

- Field intubation is the placement of an advanced airway or endotracheal tube (ET) by emergency medical services (EMS) personnel outside the hospital setting [Gnugnoli 2019]
 - Dental injury
 - Vocal cord injury
 - Laryngeal injury
 - Tracheal injury
 - False passage creation
 - Vomiting
 - Aspiration
 - Pneumonia
 - Barotrauma
 - Autonomic instability
 - Hypoxia

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Tracheostomy

- Results suggest that having a tracheostomy alone is not associated with increased aspiration risk in the acute care setting.
 - (Leder & Ross, 2010). 22/25 patients (88%) exhibited the same or resolved aspiration status from pre- to post-tracheotomy.
 - Among seven that changed, three had new aspiration post-tracheotomy due to worsening medical conditions and four had resolution post-tracheotomy due to an improved medical condition.
 - Excluding these patients (7/25), all nine patients who aspirated pre-tracheotomy did so post-operatively and the 9 who did not aspirate pre-tracheotomy still did not post-operatively.

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Cuff inflated vs Cuff deflated

Perhaps the largest retrospective case series of 632 patients who underwent VFSS with tracheostomy tube cuff both inflated and deflated (Ding & Logemann, 2005)

- Silent aspiration was significantly higher in the cuff inflated condition .
- It concluded that patients should undergo instrumental evaluation in both the cuff-inflated and deflated condition in order to return those with adequate swallow to oral intake at the earliest opportunity.

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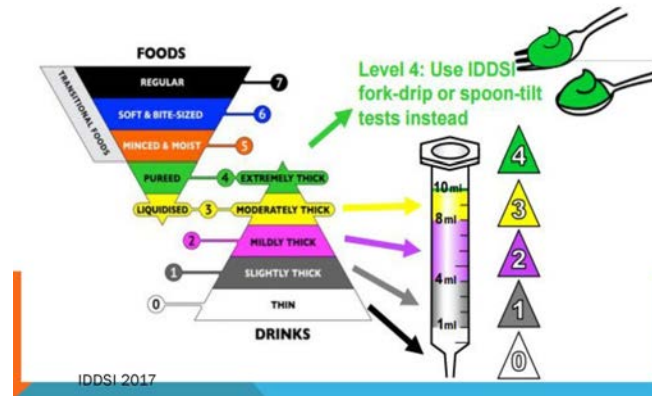
Positioning with C-collar

- Subjects with no history of dysphagia, three common cervical orthoses (Philadelphia collar, SOMI, and halo-vest brace)
- Eighty-two percent (14/17) of the subjects demonstrated radiographic changes under one or more of the bracing conditions.
- Forty-seven percent (8/17) of subjects demonstrated changes with point of initiation of the swallow response, 59% (10/17) demonstrated increased pharyngeal residue, and 23.5% (4/17) demonstrated changes with bolus flow with laryngeal penetration present.
- Aspiration did not occur under any of the bracing conditions. [Stambolis 2003]

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IDDSI

IDDSI FLOW TEST



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Nutrition Concerns

- The brain's function as the regulator for metabolic activity leads to a complex change of metabolic alterations in TBI [Cook].
 - Overall abnormal resting metabolic expenditure.
 - Abnormal tone and posturing.
 - Hypermetabolic state increases metabolic needs and protein loss.
 - Early enteral nutrition within 48 hours
 - Decreases breakdown of protein and fat stores
 - Promotes immune system

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Alternative nutrition

- Patients with moderate to severe TBI may require mechanical ventilation, which abrogates the possibility of oral intake. Thus, many TBI patients require alternative means of feeding.
- The advantages and disadvantages of parenteral and enteral nutrition are well defined. PN is often associated with an increased risk of infection, immunosuppression, hyperglycemia, hepatosteatosis, and diminished GI integrity and gut-associated lymphoid tissue (GALT).

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Feeding Tubes

- Nasally-inserted small bowel feeding access devices are generally safe and easily inserted at the bedside by a nurse.
 - These tubes do not come without risk of misplacement into the lung and should be radiologically verified before initiating feedings.
 - As many as 50% of nasoenteric tubes are eventually dislodged, typically due to patient agitation, discomfort, or inadequate sedation.
- The use of percutaneous endoscopic gastrostomy (PEG) tubes has proven successful in establishing well-tolerated feeding access within 5 days of injury.
 - Feeding TBI patients in the stomach can be challenging, particularly in the acute phases of illness.^{18,19}
 - TBI patients often exhibit impaired gastric emptying due to vagus nerve damage,
 - Nasally-inserted small bowel feeding access devices are generally safe and easily inserted at the bedside by a nurse. These tubes do not come without risk of misplacement into the lung and should be radiologically verified before initiating feedings. As many as 50% of nasoenteric tubes are eventually dislodged, typically due to patient agitation, discomfort, or inadequate sedation. [Cook]

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Clinical signs of feeding intolerance

- Start slow, usually 50% can be tolerated by day 2, with full calories by day 7.
- Abdominal distention
- Aspiration Pneumonitis
- Diarrhea
 - Often not caused by the feedings
 - Sorbitol used in liquid medications often causes cramping and diarrhea
 - Hypoalbuminemia caused bowel edema and impaired absorption
[Cook 2008]

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Medications and Nutrition Interactions

- Fentanyl / Morphine (paralytic) - decrease GI motility
- Phenytoin (anticonvulsant) - absorption reduced by enteral feeding
- Ciprofloxacin (antibiotic) - absorption decreased by 44% secondary to chelation.
- Other drug interactions may affect concentrations of nutrients and electrolytes [Cook 2008]

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