



Swallowing and Breathing ~ Sharing a Common Connection

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SCI Unit ~ RIC 7th Floor Gym



Course Objectives



Upon completion of this course, participants will be able to:

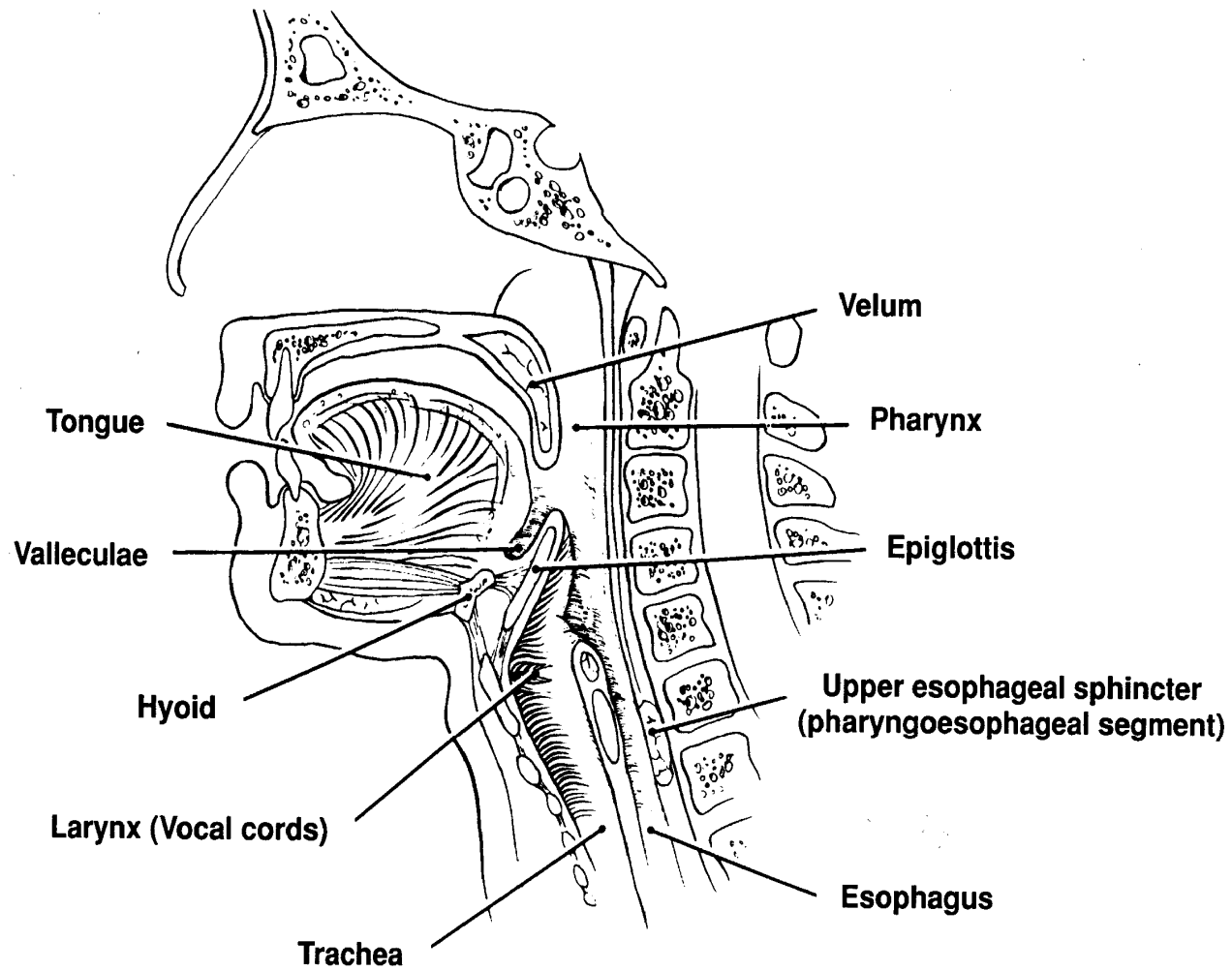
1. Describe normal and disordered **swallowing function**
2. State the role and importance of **upper airway airflow** for swallowing function
3. Discuss the relationship between **breathing** and **swallowing**
4. Describe how to use the **relationships** between the respiratory and digestive systems to improve swallowing function



The Swallow Evaluation



- dysphagia is a major cause of morbidity, mortality and costly disability
- proper assessment is critical
- typical choices in the medical setting
 - CSE, FSS, FEES
- must choose the best examination for our patients under the existing constraints of our setting
- swallow eval of the future must include a closer look at breathing



Cranial Nerves



- CN V: Trigeminal
- CN VII: Facial
- CN IX: Glossopharyngeal
- CN X: Vagus
- CN XI: *Spinal Accessory
- CN XII: Hypoglossal

Phases of Swallowing



- anticipatory phase
 - oral preparation phase
 - oral phase (<1 second)
 - pharyngeal phase (<1 second)
 - esophageal phase (8-20 seconds)
- *These phases are very fluid and recent research “highlights the artificiality of separating the swallowing continuum into isolated phases”.*
- *(B. Martin-Harris)*

Common Etiologies of Dysphagia



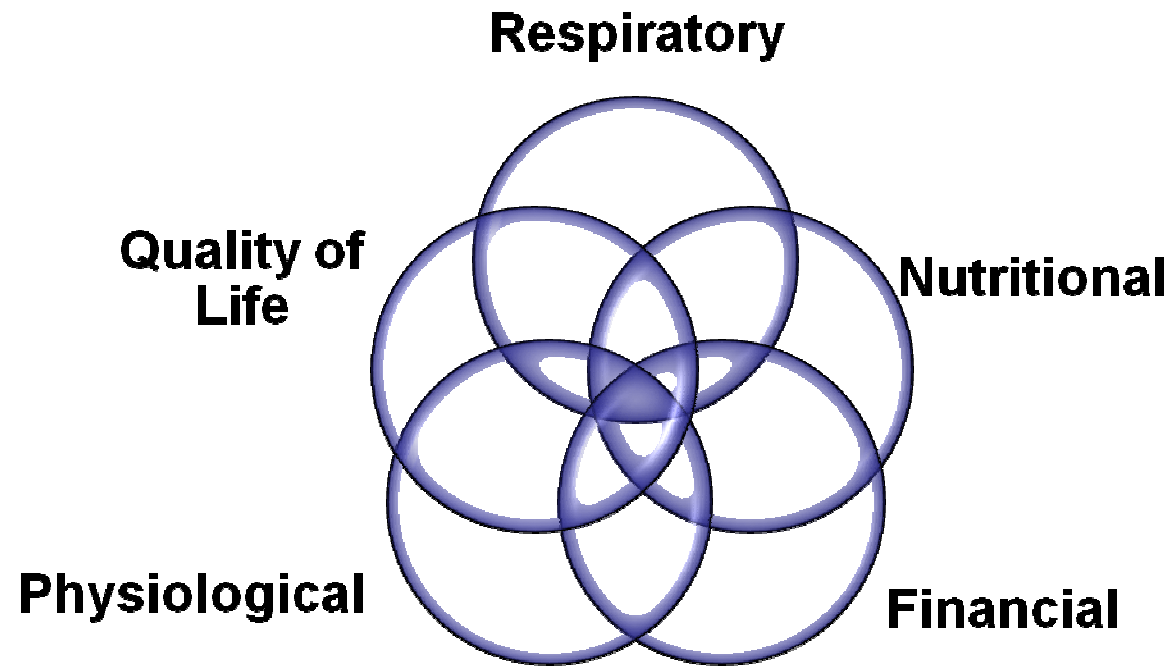
- stroke
- traumatic brain injury
- other neuromuscular disorders and disease
 - Parkinson's disease
 - Multiple Sclerosis
 - Myasthenia Gravis
 - Amyotrophic Lateral Sclerosis
- head and neck tumors

Common Etiologies of Dysphagia



- generalized weakness secondary to cardiovascular procedures, other surgery or severe metabolic disorders
- spinal cord injury
- tracheostomy tube / mechanical ventilation
- idiopathic
- iatrogenic

Swallowing Outcomes



Whose Turn is it Anyway?



- **Exhale-Swallow-Exhale** is the preferred pattern for healthy adults

Normal vs. Diseased States

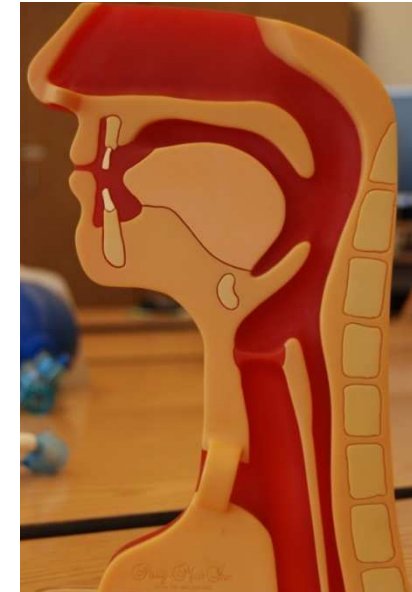


- What can disrupt the coordinated pattern?
- Can swallow-respiratory discoordination increase aspiration risk?
- What do we know about swallow-respiratory coordination of the disordered groups?
 - Parkinson's disease
 - COPD
 - Cancer
 - Sleep apnea
 - Trach / Vent
 - Aging swallow

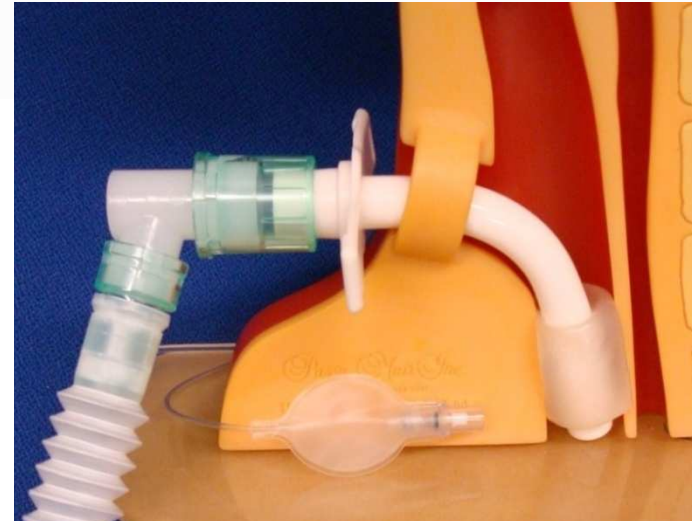
Are We Inextricably Linked?



- Do lung volumes play a role?
- What do we understand about the subglottis?
- What about pressure?
- What do we know about the timing of the swallow in the respiratory cycle?
- How about those lung-thoracic unit recoil forces?



All Things to Consider



High Risk for Aspiration



- reduced arousal / alertness
- reduced responsiveness to stimulation
- absent swallow response
- absent productive cough
- difficulty handling secretions
- significant reduction in ROM and strength of oral motor and laryngeal movements
- *? decreased swallow-respiratory coordination*

Clinical Signs of Aspiration



- coughing / choking
- throat clearing
- wet “gurgly” vocal quality
- chest heaving / increased respiratory rate
- other signs of distress
- elevated temperature
- acoustic changes in the lung fields

Severe Respiratory Distress



- diaphoresis and nasal flaring
- heightened sternomastoid activity
- recession in suprasternal and supraclavicular spaces
- tachypnea over the course of a minute
- intercostal space recession
- paradoxical motion of the abdomen
- tachycardia



“The Blue Dye Test”



- blue dye placed on patient’s tongue at preset intervals
- patients secretions monitored for presence of blue dye upon suction
- presence of blue dye in secretions indicates aspiration of patients own secretions
- **advantages**
 - no food or liquid presented
 - non-invasive and requires no special equipment
 - can serve as a “screening” for determining if some patients are appropriate for more formal swallow evaluation
- **disadvantages**
 - does not allow for assessment of the effects of consistency
 - does not indicate the cause of aspiration

“Modified Evan's Blue Dye Test (MEBDT)”



- food and/or liquids are dyed blue
- patient's secretions monitored for presence of blue dye upon suctioning
- **advantages**
 - allows for assessment of consistency (thick vs. thin, etc.)
 - allows for assessment with one-way speaking valve
- **disadvantages**
 - validity has been questioned in the research
 - may not identify aspiration that occurs later due to pharyngeal residue
 - if more than one consistency is presented, there is no way of determining which consistency was aspirated
- What are the other options?

Systemic Absorption of Blue Dye



- 2 critically ill patients with sepsis received enteral feedings with blue dye no. 1
- Skin and serum turned green / blue
- patients died of refractory hypotension and acidosis
- FD&C Blue No. 1 and related dyes have a toxic effects on mitochondria, suggesting that dye absorptions is harmful
- recommend judicious use of food dye in patients with sepsis
 - » Maloney JP, Halbower AC, Fouty BF et al. Systemic absorption of food dye in patients with sepsis. *N Engl J Med* 2000 Oct;343(14):1047-8.
 - » Maloney JP, Ryan TA, Brasel KJ et al. Food dye use in enteral feedings: a review and call for a moratorium. *Nutr Clin Pract* 2002 Jun;17(3):140-1.

Why Fluoroscopic?



- measures speed of swallow
- measures efficiency of swallow
- defines movement patterns
- determines if penetration or aspiration occurs
 - when, why, how much
- examines effectiveness of treatment

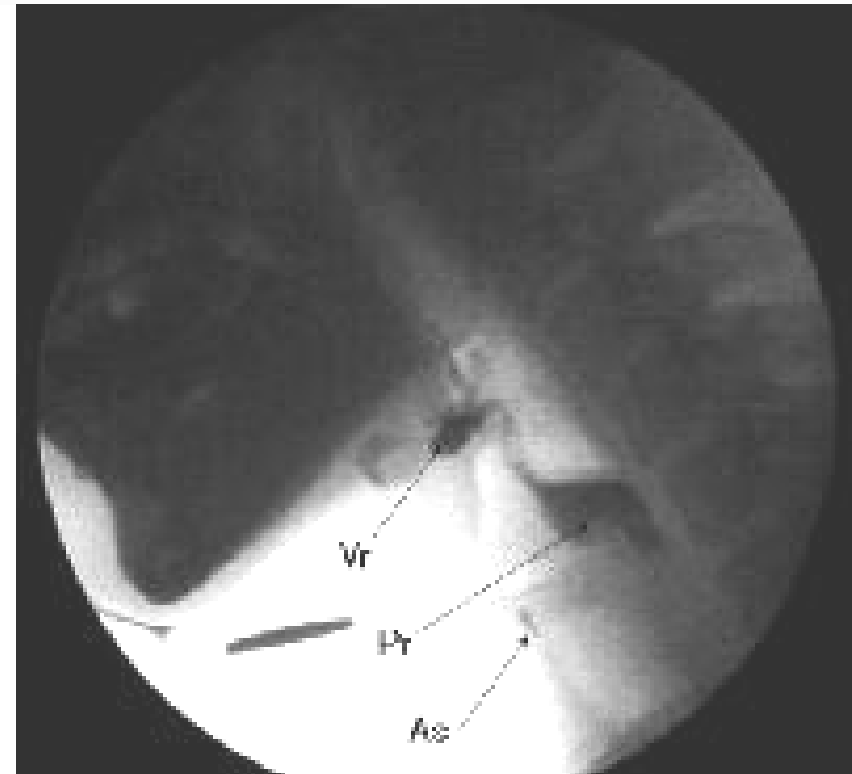
FSS



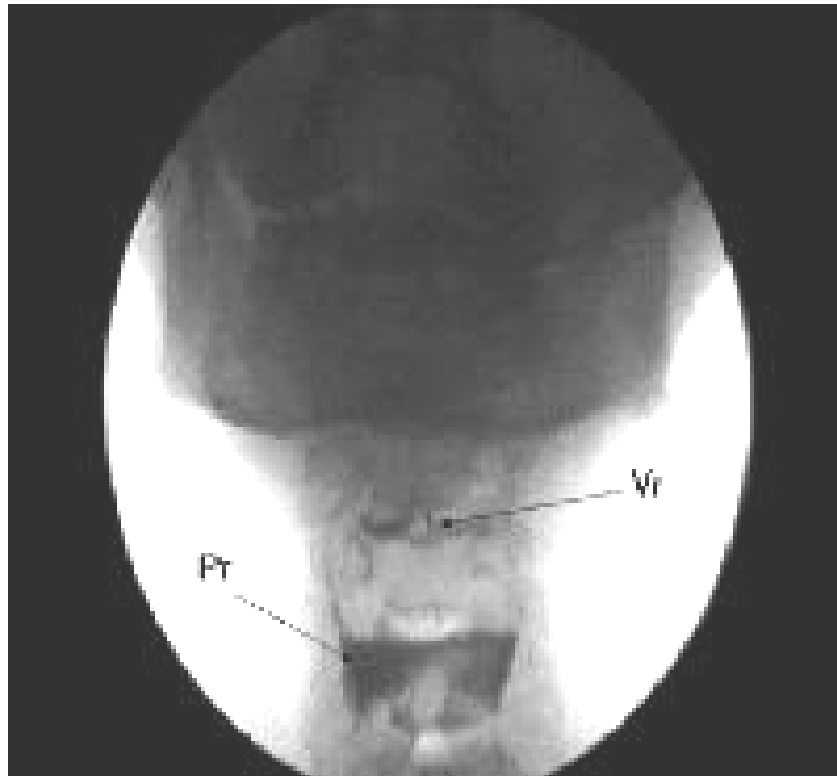
- examination of treatment strategies by X-ray can impact diet and recovery from dysphagia
- ~83% of patients receiving a FSS may receive changes in at least 1 of 5 important clinical variables
 - referrals to other specialists
 - swallow therapy
 - compensatory strategies
 - change in mode of nutritional intake
 - diet

» Martin-Harris B, Logemann JA et al. Clinical utility of the Modified Barium Swallow. *Dysphagia* 2000;15:136-141.

Fluoroscopic Swallow Study Images



Fluoroscopic Swallow Study Images



Vent Swallowing and Breathing



- sharing of system
- changes in timing of airway closure
- discoordinated pattern of swallowing and breathing
- disruption of normal apneic interval
- reduced secretion and saliva management
- reduced respiratory defenses

Aspiration



- Langmore and colleagues found that while **dysphagia** and **aspiration** are important risk factors for aspiration pneumonia, **they are insufficient to cause pneumonia unless other factors are present**. Predictive risk factors for included dependency for feeding and oral care, number of decayed teeth, tube feeding, more than one medical diagnosis, number of medications and smoking.

» Langmore SE, Terpenning MS, Schork A et al. Predictors of aspiration pneumonia: how important is dysphagia? *Dysphagia* 1998;13:69-81.

Predictors of Aspiration Pneumonia



- cross-sectional retrospective analysis of nursing home residents
- N = 102,824
- 18 significant predictors of aspiration pneumonia from strongest to weakest

» Langmore SE, Skarupski KA et al. Predictors of aspiration pneumonia in nursing home residents. *Dysphagia* 2002;17(4):298-307.

Predictors of Aspiration Pneumonia



- suctioning use
- COPD
- CHF
- presence of tube feeding
- bedfast
- high case mix index
- delirium
- weight loss
- swallowing problems
- mechanically altered diet
- UTI
- dependence for eating
- bed mobility
- locomotion
- number of medications
- age
- stroke
- tracheostomy care

Trach / Vent Population



- individuals with tracheostomy and receiving mechanical ventilation are among the most ill and medically complex patients
- prone to aspiration
- critical to regularly assess these patient in multiple scenarios
- no single scenario works for all patients
- every patient is unique



Trach / Vent Population



- flaw in the literature – no pre-trach data
- very complicated subjects that confound the data
- some studies have shown that 67% of vent patients do NOT aspirate
- yet of the 33% that do aspirate, in 82% of those patients – the aspiration is SILENT



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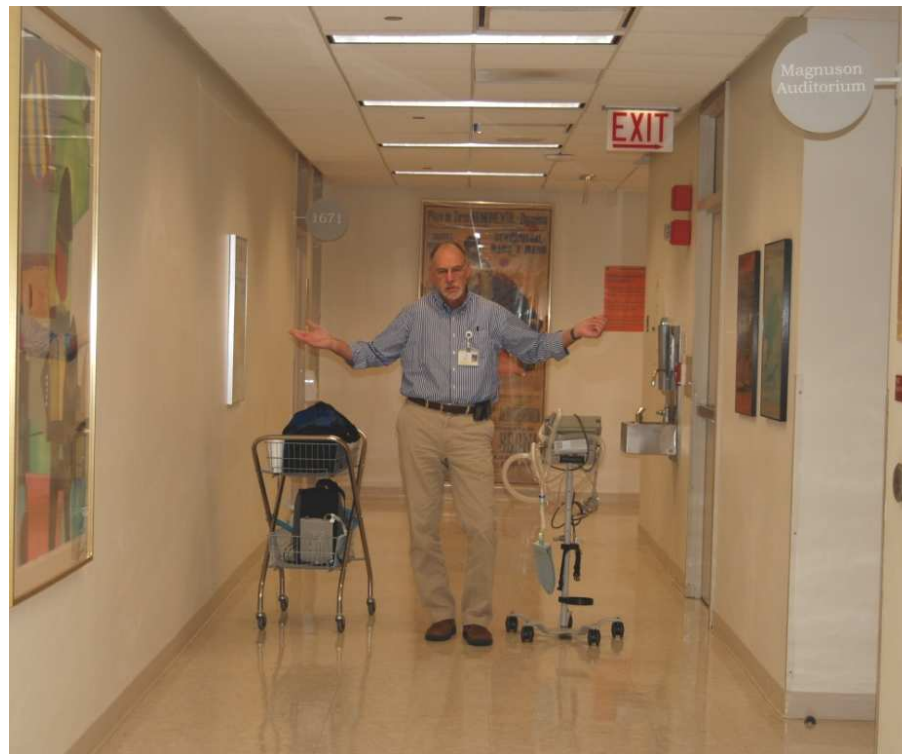
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Research / References



- Belafsky PC, Blumenfeld L, LePage A, Nahrstedt K. The accuracy of the modified Evan's blue dye test in predicting aspiration. *Laryngoscope* 2004 Sep;114(9):1680-1.
- Coyle JA. *Ventilation, Respiration, Pulmonary Disease and Swallowing. Perspectives.*
- Davis LA, Stanton ST. Characteristics of dysphagia in elderly patients requiring mechanical ventilation. *Dysphagia* 2004 Jan;19(1):7-14.
- Dikeman KJ, Kazandjian MS. *Communication and Swallowing Management of Tracheostomized and Ventilator-Dependent Adults.* San Diego: Singular Publishing Group, Inc., 1995.
- Elpern EH, Jacobs ER, Bone RC. Incidence of Aspiration in Tracheally Intubated Adults. *Heart & Lung* 1987;105(2):563-566.
- Elpern EH, Scott MG, Petro L, Ries MH. Pulmonary aspiration in mechanically ventilated patients with tracheostomies. *Chest* 1994;16(5):527-531.

Research / References



- Elpern EH, Okonek MB, Bacon M, Gerstung C, Skrzynski M. Effect of the Passy-Muir tracheostomy speaking valve on pulmonary aspiration in adults. *Heart & Lung* 2000;29:287-93.
- Fornataro-Clerici L, Roop TA. *Clinical Management of Adults Requiring Tracheostomy Tubes and Ventilators*. Gaylord: Northern Speech Services, Inc., 1997.
- Gross RD. *Subglottic Air Pressure and Swallowing*. Perspectives.
- Gross RD, Mahlmann J, Grayhack JP. Physiologic effects of open and closed tracheostomy tubes on the pharyngeal swallow. *Ann Otol Rhinol Laryngol* 2003 Feb;112(2).
- Gross RD, Steinhauer KM, Zajac DJ, Weissler MC. Direct measurement of subglottic air pressure while swallowing. *Laryngoscope* 2006;116(5):753-61.
- Langmore SE, Terpenning MS, Schork A et al. Predictors of aspiration pneumonia: how important is dysphagia? *Dysphagia* 1998;13:69-81.

Research / References



- Langmore SE, Skarupski KA et al. Predictors of aspiration pneumonia in nursing home residents. *Dysphagia* 2002;17(4):298-307.
- Lee MJ, Bazaz R, Furey CG, Yoo J. Risk factors for dysphagia after anterior cervical spine surgery: a two-year prospective cohort study. *The Spine Journal* 2007;7:141-147.
- Leder SB. Aspiration following use of one-way tracheostomy speaking valve in previously aspirating patients. *ASHA Leader* 1998;3:133.
- Leder SB, Ross DA. Confirmation of No causal relationship between tracheostomy and aspiration: a direct replication study. *Dysphagia* 2009.
- Leder SB, Ross DA, Burrell MI et al. Tracheostomy tube occlusion status and aspiration in early post surgical head and neck cancer patients. *Dysphagia* 1998;13:167-171.

Research / References



- Leder SB, Suiter DM, Lisitano Warner H. Answering orientation questions and following single-step verbal commands: effect on aspiration status. *Dysphagia* 2009.
- Leder SB, Tarro JM, Burrell MI. Effect of occlusion of a tracheostomy tube on aspiration. *Dysphagia* 1996; 11:254-258.
- Leder SB. Incidence and type of aspiration in acute care patients requiring mechanical ventilation via a new tracheotomy. *Chest* 2002 Nov;122(5):1721-1726.
- Maloney JP, Halbower AC, Fouty BF et al. Systemic absorption of food dye in patients with sepsis. *N Engl J Med* 2000 Oct;343(14):1047-8.
- Maloney JP, Ryan TA, Brasel KJ et al. Food dye use in enteral feedings: a review and call for a moratorium. *Nutr Clin Pract* 2002 Jun;17(3):140-1.
- Martin-Harris B. Optimal patterns of care in patients with chronic obstructive pulmonary disease. *Semin Speech Lang* 2000;21(4):311-21.

Research / References



- Martin-Harris B, Logemann JA et al. Clinical utility of the Modified Barium Swallow. *Dysphagia* 2000;15:136-141.
- Suiter DM, McCullough GH, Powell PW. Effects of cuff deflation and one-way tracheostomy speaking valve placement on swallowing physiology. *Dysphagia* 2003;18:284-292.
- Tippet DC. *Tracheostomy and Ventilator Dependency Management of Breathing, Speaking, and Swallowing*. New York: Thieme, 2000.
- Yoneyama et al. Oral care reduces pneumonia in older patients in nursing homes, *J Am Geriatr Soc* 2002;50:430-433.

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