The Normal Swallow: Is It Really What You Think It Is?

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Disclosures

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What is normal?: Oral

• Oral tongue under voluntary control
  • Manipulates bolus in mouth for chewing
  • Senses volume and viscosity
  • Subdivides food as needed
  • Seals against lateral and anterior alveolar ridge
  • Propels bolus posteriorly
    • Upward movement of midline
    • Keeping pressure against tail of bolus
  • Bolus is cleared from oral cavity

Logeman, 1983
What is normal?: Pharyngeal

- Moves into involutory control
  - Soft palate elevates
  - Laryngeal elevation
  - Hyoid excursion
  - Laryngeal vestibule closure
  - Pharyngeal stripping wave
  - Pharyngeal contraction
  - PES opening
  - Full BOT retraction
  - Clearance of bolus through PES

Martin-Harris et al, 2008
What is normal?: Esophageal

• Involuntary (except for the extremely talented)
  • Relaxation of esophagus and LES
  • Peristaltic contraction
  • Bolus cleared into stomach by gravity and contraction

Goyal, 2006
What is disordered?

• “A disruption to the normal functioning”
  • Oxford dictionary
The perfect patient
Normal?: Test your skill!
Variations on normal?

• Can vary with:
  • Age
  • Structural changes
  • Congenital conditions
  • Acquired conditions
Age Related Variations

- Increased time through all phases of swallow
  - Oral:
    - Slower bolus formation
    - Longer transfer
  - Pharyngeal:
    - Increased time of bolus in pharynx prior to swallow
    - Increased time of maximum hyolaryngeal excursion
  - Pharyngoesophageal:
    - Increased time for UES relaxation
  - Esophageal
    - Slower clear
- Reaction time to sensory stimuli increases

Age Related Variations

• Sarcopenia
  • Age related loss of muscle mass, organization and strength (Robbins et al, 2006)

• Reduced strength in swallowing mechanisms
  • Reduced isometric tongue pressure
  • Atrophy of the pharyngeal muscles
    • Increase in pharyngeal residues
  • Decrease in amplitude of peristaltic waves in esophagus, decreased pressure in LES and UES

• SWALLOWING IS SUBMAXIMAL
Age Related Variations

• Decreased functional reserve
  • Our ability to adapt to stress
    • Illness
    • Changes in structures
    • Changes in activity level
  • When faced with acute illness, certain medications, etc can be more prone to dysphagia
Structure Related Variations

• Certain structures can change “normal” swallow patterns
• Apples vs Oranges?
Structure Related Variations: Torus Palatine

- Bony protrusion on palate
  - Midline
  - Fairly common
- Increases oral phase time and coordination
- Can increase in size with age

Neville et al., 2002
Structure Related Variations: Dentition

• Full dentures=Normal dentition?
  • More muscle activity
  • Larger bolus particles
  • Mastication in denture wearers near to mastication of people with neuro impairment Woda et al, 2006

• Longer deglutition
  • Increased time for total swallow in edentulous normal
    • Gokce et al, 2012
Aortic Arch

- Aortic arch snug against esophagus
- Just below the clavicle
- Slow down of bolus at this impingement
- Can increase with age
- Also the area of lowest amplitude of peristaltic wave
Human Related Variations

• Differences in “normal”
• Normal vs Perfect
• What is normal for YOU??
Human Related Variations: Mastication

- How do you assess mastication?
  - Time? Strokes? Pattern?
  - Clinically vs Instrumentally

- Time, pattern, strokes wide variability
  - More consistent is granularity of bolus
  - Mishellany et al, 2006

- Influencing factors
  - Salivary flow
  - Bolus type, size
Human Related Variations: Piecemeal Deglutition

- Multiple swallows per bolus
- Normal
  - Dziadziola, 1992
    - Incidence of multiple swallows per bite across disordered and normal for liquids and paste
  - Ertekin, 1996
    - Seen in normal in bolus size larger than 20 mL
Human Related Variations: Premature Spillage

• **Normal**
  • Saitoh, 2007
    • accumulation of solid bolus into pyriforms
    • One subject with bolus in pyriforms for 14 seconds
  • **Stephen et al, 2005**
    • distance between head of bolus and tongue base/ramus intersection varied from 47.4 mm above to 34.9 mm below among subjects
    • within subjects varied 25.8 above to 15.5 below
  • **Mendel, Logemann, 2007**
    • 100 normal subjects
    • Timing in relation to UES opening
    • Wide variability with volume, consistency and age
Premature Spillage

- Premature? Spillage?
  - Implications of terminology
  - Passive loss vs Active propulsion
- Disordered
  - Impaired bolus containment/control
  - Delayed pharyngeal onset
Penetration

- 2010 Allen et al: Penetration found in 11% normal
  - 9.3% under 65 years; 14.3% over 65 years
  - More likely with liquids, more likely with larger bolus size

- 2007 Dagget et al: Penetration found in normal
  - 7.4% of swallows under 50; 16.8% swallows over 50
  - No sensorimotor response to penetration

- 1999 Robbins et al: Normal vs abnormal penetration
  - All penetration in “normal” group: 2 or 3 on PAS
  - No scores of 4 or 5 in the healthy group
Aspiration

• Normal?
  • Robbins et al, 1999
    • During development of PAS
    • Normal subjects with worse PAS score on first swallow of new condition
    • Normal subject with aspiration
  • Butler et al, 2009
    • Normal subjects with aspiration
    • 3% of 545 swallows resulted in aspiration
Aspiration

• Normal?

• Sleep studies
  • Gleeson et al, 1997
    • Found aspiration of secretions during sleep in healthy normal
  • Huxley et al, 1978
    • Aspiration in 45% of normals during sleep
    • Non-aspirators slept poorly
Condition Related Variations

- Apples vs Oranges?
- Normal vs Perfect
Down’s Syndrome

• Oral anatomical differences
  • Macroglossia, small oral cavity, hypotonia, hypersensitivity
  • No correlation between severity of oral differences and aspiration
    • (Frazier, Freedman, 1996)
• Oral phase dysphagia
  • 63%
    • Not a predictor of pharyngeal dysphagia, aspiration
      • Jackson et al, 2016
• Higher incidence of digestive disorders
Dementia

• Motor and sensory changes
• Oral holding/pocketing
• Anterior oral bolus loss
• Longer length of time in pharynx prior to swallow onset
• Age related changes?

Easterling & Robbins, 2008
ALS

• Anterior oral bolus loss
• Difficulty with bolus formation/transfer
• Slowed initiation of pharyngeal phase
• Increased meal duration
• Fatigue with meal progression


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Parkinson’s

- Prolonged oral transfer
- Increased tongue movement
- Prolonged oropharyngeal transit
- Decreased sensation
  - Silent aspiration
- Slowed clear through esophagus and LES
- Slowed return to pre-swell position

Bushman et al, 1989; Johnston et al, 1995; Leopold & Kagel, 1997;
Normal or Disordered???

• Think critically about your patient
• ASHA Preferred Practice Guidelines
  • Swallow assessment should include description of normal and abnormal structures and physiology
• ASHA Training Guidelines for assessment
  • VFSS: Identification of normal and abnormal anatomy and physiology
  • FEES: Identification of viewable normal and abnormal anatomy and physiology
  • Clinical: Knowledge of normal and abnormal anatomy and physiology
Normal or Disordered???

• What other clues??
  • Lung status
  • Patient QOL
  • Dental status
  • History
  • Nutritional status/hydration
  • Weight maintenance
  • PO intake
  • Co-morbidities
  • Cognitive status
  • Mobility
Ethical Considerations

• ASHA: Evidence Based Practice
  • Integration of
    • Clinical expertise
    • External scientific evidence
    • Patient values/preferences

• Medical Necessity
  • Medicare defines:
    • Service that is reasonable and necessary for the diagnosis or treatment of an illness or injury, or to improve the functioning of a malformed body member.
In Conclusion:

- Think critically about the whole patient
- Swallowing: It’s complicated
- What is risk?
- What are we trying to save our patients from?
References


