Anterior Cervical Fusion: What is the Effect on Swallow Function?

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STATE OF THE ART EVALUATION

"It's the newest endoscopy technique. This ladybug is equipped with a tiny video camera and has been trained to thoroughly explore your nasal passages."
Anterior Cervical Fusion

- Bone graft with instrumentation
  - Internal fixation
- Bone graft without instrumentation
- Single v. Multi-level procedures
- Discectomy (disc only) v. Corpectomy (disc and vertebral body)
  - University of Maryland Medical Center
Anterior Cervical Fusion
Background

- Little in the Speech-Language Pathology literature regarding this issue
- Structures known to be at risk (Lee et al)
  - Glossopharyngeal and hypoglossal nerves above C3
  - Superior laryngeal nerve at C3-4
  - Recurrent laryngeal nerve and Vagus trunk at lower cervical areas
  - Scar tissue formation/swelling
  - Cricopharyngeus at C5-6
### History

- **Table 1. A sample of published literature on incidence of dysphagia (Lee et al)**

<table>
<thead>
<tr>
<th>Author/year</th>
<th># of patients</th>
<th>Incidence of dysphagia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caspar et al (1989)</td>
<td>60</td>
<td>1.7%</td>
</tr>
<tr>
<td>Saunders et al (1991)</td>
<td>40</td>
<td>2.5%</td>
</tr>
<tr>
<td>Stewart et al (1995)</td>
<td>73</td>
<td>45%</td>
</tr>
<tr>
<td>Martin et al (1997)</td>
<td>247</td>
<td>6.5%</td>
</tr>
<tr>
<td>Schneeberger et al (1999)</td>
<td>35</td>
<td>5.7%</td>
</tr>
<tr>
<td>Frempong-Boadu et al (2002)</td>
<td>23</td>
<td>48%</td>
</tr>
<tr>
<td>Bazaz et al (2002)</td>
<td>249</td>
<td>50.3% at one month</td>
</tr>
<tr>
<td>Smith-Hammond et al (2004)</td>
<td>83</td>
<td>50%</td>
</tr>
<tr>
<td>Yue et al (2005)</td>
<td>74</td>
<td>35.1% avg. of 7.2 year f/u</td>
</tr>
</tbody>
</table>
Research Background

Martin et al (1997)
- 13 patients
- Found various patterns of swallow function
- 3/13 absent pharyngeal swallow (consistent with SLN injury)
- 4/13 oral/preparatory phase dysphagia (consistent with hypoglossal nerve damage)
- 5/13 absent or weak pharyngeal phase; 3 resulting in aspiration
- 2/13 post-operative pre-vertebral soft tissue swelling
  - Reduced pharyngeal wall movement
  - Impaired UES opening
  - Incomplete epiglottic inversion
  - Residue following the swallow
Prospective Studies

  - 23 patients undergoing elective ACDF
  - Evaluated pre and post-op (1 month) with barium swallow study
  - 48% of cohort had pre-op swallowing abnormality
  - Of the patients with pre-op dysphagia, 1 got worse, 3 improved, and 7 were stable
  - Post-op 67% of patient who DID NOT have pre-existing findings demonstrated new barium swallow abnormalities
  - Post-op prevertebral or pharyngeal swelling was observed in 61% of patients, and 86% of these had abnormal swallowing tests
Prospective Studies (cont)

- **Bazaz et al (2002)**
  - Analyzed 249 patients with anterior cervical spine surgery
  - Contacted patients at 1, 2, 6, 12 months
  - Rated dysphagia mild, moderate, or severe based on the Bazaz-Yoo dysphagia score
At one month 50.2% had some level of swallowing difficulty; 5.6% were severe.
At six months, 17.8% experienced dysphagia.
At twelve months, 12.5% had dysphagia.
Prospective Studies (cont)

  - Used patients who underwent posterior cervical or posterior lumbar procedures during the same time period as the control group
  - Utilized MBS and FEES pre and post
  - Post-op evaluations were performed 2.0+/−1.5 days after surgery
  - 83 patients were evaluated
Incidence of dysphagia in the anterior cervical surgery group was 47% (18/38)
71% (12/17) of the patients with dysphagia returned to a regular diet within 2 months
23% (4/17) of patients who had post-op dysphagia required some level of compensatory intervention up to 10 months after surgery
Prospective Studies (cont)

- Lee et al (2007)
  - Excluded patients with pre-op dysphagia
  - Telephone interviews conducted at 1, 2, 6, 12, and 24 months
  - “Do you have any difficulty swallowing at this time?”
  - Risk factors: female gender and surgeries involving at least 3 levels
Prevalence of Dysphagia

- 1 month: 54%
- 2 months: 33.6%
- 6 months: 18.6%
- 12 months: 15.2%
- 24 months: 13.6%
Individual Factors

- **Gender**
  - Women with more persistent incidence of dysphagia (18.3%; 9.9%)

- **Age**
  - Average age of patient with symptoms was 53.1 years and asymptomatic patients was 52.13 years
Primary v. Revision

- At one month:
  - 53.3% in primary surgery group
  - 62% in revision group
  - At 1 and 2 year follow-up dysphagia prevalence in revision group exceeded twice that in primary group (12.9% v. 29.7% at one year) (11.3% v. 27.7% at 2 years)
## Prevalence of Dysphagia by Surgical Level

<table>
<thead>
<tr>
<th>Time</th>
<th>C3-4</th>
<th>C4-5</th>
<th>C5-6</th>
<th>C6-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 month</td>
<td>75%</td>
<td>57.8%</td>
<td>30%</td>
<td>39.1%</td>
</tr>
<tr>
<td>2 months</td>
<td>33%</td>
<td>31.2%</td>
<td>12.8%</td>
<td>34.7%</td>
</tr>
<tr>
<td>6 months</td>
<td>18%</td>
<td>21%</td>
<td>5.1%</td>
<td>22.7%</td>
</tr>
<tr>
<td>1 year</td>
<td>18%</td>
<td>21%</td>
<td>5.1%</td>
<td>10%</td>
</tr>
<tr>
<td>2 years</td>
<td>18%</td>
<td>15.8%</td>
<td>5.1%</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>1 Level</td>
<td>2 levels</td>
<td>3+ levels</td>
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<td></td>
</tr>
<tr>
<td>1 month</td>
<td>42.8%</td>
<td>58.6%</td>
<td>6.0%</td>
<td></td>
</tr>
<tr>
<td>2 months</td>
<td>23.7%</td>
<td>37.8%</td>
<td>38.0%</td>
<td></td>
</tr>
<tr>
<td>6 months</td>
<td>14.7%</td>
<td>15.7%</td>
<td>23.3%</td>
<td></td>
</tr>
<tr>
<td>1 year</td>
<td>11.8%</td>
<td>11.5%</td>
<td>20.6%</td>
<td></td>
</tr>
<tr>
<td>2 years</td>
<td>10.7%</td>
<td>8.7%</td>
<td>19.3%</td>
<td></td>
</tr>
</tbody>
</table>
Yue et al (2005)

- 74 patients returned for follow-up an average of 7.2 years after anterior cervical spine procedures
- Varying degrees of dysphagia were present in 35% of patients (n=26)
- 16.2% had moderate dysphagia
As much as 50% of patients may have some degree of dysphagia peri-operatively.

Risk factors may include older patients (>60 years of age), multilevel surgery, and patients with pre-existing swallowing dysfunction.
Patient Case Presentation
Patient Case

- D.C.
- 56 year old male
- Referred for swallowing evaluation s/p cervical fusion September 2007
Patient Case

- Medical History
  - C4,5-6 cervical fusion surgery (2 levels)
  - Hypothyroidism
  - Benign Pituitary Tumor removed 1983
  - Radiation of the head 1984
  - No speech/swallow side effects reported following brain surgery and radiation
  - No current medications
History

- **Barium Swallow 12/08:**
  - Transient narrowing at level of the cricopharyngeus muscle
  - Cricopharyngeal bar

- **Dysphagia complaints:**
  - More difficulty with solids than liquids
  - Food gets caught lower in throat
  - Tends to cough/choke after swallowing
  - Pain with swallowing
  - Avoiding dry, piece-meal foods (popcorn, nuts, etc)
History (cont)

- Reflux Symptom Index (RSI)
  - 19/45

- FEES completed 2/3/09
Video Swallow Study
VSS
VSS
VSS
FEES Results

- Oral mechanism examination revealed an overall decrease in strength and timing of mechanism and control for bolus preparation
- Minimal pooling of secretions at baseline
- Thin and thick liquids-tolerated without difficulty and minimal residue
FEES Results Continued

- **Puree**
  - Residue in valleculae cleared with multiple swallows and liquid chaser
  - Retroflex movement of epiglottis was incomplete

- **Solid**
  - Residual in valleculae cleared with multiple swallows and liquid chaser

- **Placebo Pill**
  - Lodged in valleculae
  - Cleared with applesauce and liquid chaser
  - 10 swallows, cleared as it melted
Findings of Evaluation

- Mild to moderate pharyngeal/esophageal dysphagia
- Restricted retroflex movement of the Epiglottis
- Dismotility of hypopharynx
- Cervical fusion
- Cricopharyngeal bar
- Disuse phenomenon secondary to reduced range of motion
Treatment Options/Plan of Care

- Benefits from head turn
- Alternating liquids and solids
  - (liquid wash)
- Decreased bolus size
- Recommend consider botox myotomy to be determined by ENT
Swallow is a highly coordinated, synchronized series of events involving two central pattern generators and 6 cranial nerves. This pattern transfers bolus (bite of food) from the mouth to the stomach in approximately 1/10\textsuperscript{th} of a second.

It is no wonder that any simple breakdown in this complex system creates a dysfunction.


THANK YOU