RELATIONSHIP BETWEEN THE PRESENCE OF & PERCEPTION OF LARYNGEAL MUCUS

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Why talk about this?
Frequent Complaint

• ENT and SLP clinics are flooded with patients complaining of ...

  – Irritating laryngeal sensation
  – Excessive mucus
  – Chronic coughing and throat clearing
Cycle

Cause of Sensation

Reaction to Cough

Temporary Sensation Relief

Cough

Sensation

Urge to Cough
Cycle

Cause of Sensation

Reaction to Cough

Temporary Sensation Relief

Sensation

Urge to Cough

Cough
Cycle

- Cause of Sensation
- Reaction to Cough
- Temporary Sensation Relief
- Cough
- Urge to Cough
- Sensation
Cycle

- Cause of Sensation
- Reaction to Cough
- Temporary Sensation Relief
- Urge to Cough
- Cough
- Sensation

The cycle starts with the cause of sensation, leading to the urge to cough, then to temporary sensation relief, and finally back to the reaction to cough, completing the cycle.
Cycle

Cause of Sensation

Reaction to Cough

Temporary Sensation Relief

Cough

Sensation

Urge to Cough
Cycle

Cause of Sensation = Mucus

Reaction to Cough = ↑ Mucus Secretion

Sensation = Irritation

Temporary Sensation Relief

Urge to Cough

Cough
This talk will focus on ...

- Is laryngeal sensation related to mucus aggregation?
Assessing Laryngeal Sensation

• Are **patient reports** a good source of information?
  – Reliable?
  – Valid?
  – Sensitive?
  – Specific?
Assessing Laryngeal Sensation

• Is **air pressure** testing a good source of information?
  – Reliable?
  – Valid?
  – Sensitive?
  – Specific?
Assessing Mucus Aggregation

• The mucus aggregation can be judged from endoscopy recordings on the following scales:
  – Type (Types 1, 2, 3)
  – Pooling (not apparent, mild, severe)
  – Thickness (not apparent, mild, severe)
  – Location (anterior, medial, posterior)

(Bonilha et al, 2008; Hsiao et al, 2002; & Hsuing, 2004)
Type 1 Mucus

• A rough surface of the vocal folds and by mucus threads between the vocal folds noted during vocal fold vibration or abduction

(Hsiao et al, 2002; Bonilha et al, 2008)
Type 2 Mucus

- Mucus bubbles visible upon phonation, which may resemble vocal fold nodules

(Hsiao et al, 2002; Bonilha et al, 2008)
Type 3 Mucus

• Mucus lumps either prior to or during phonation along the edge and/or surface of the vocal folds

(Hsiao et al, 2002; Bonilha et al, 2008)
This talk will ...

• Focus on patient report of laryngeal sensation

• And compare it with visual reports of mucus aggregation on the vocal folds

• With a goal of providing evidence for future clinical decision making and identifying parameters of interest for dx and tx procedures
Hypothesis

We hypothesized that:

- Type 3, Severe thickness and Severe pooling would relate to a higher frequency of reporting irritating laryngeal sensation than Types 1 and 2, or Mild thickness or Mild pooling
Methods

- 46 persons, 22 with and 24 without voice disorders, participated in this study.

- Participants were asked about the presence of laryngeal sensation and underwent a stroboscopy examination.
Methods

• Prior to the endoscopy, the participant was asked to judge their level of laryngeal irritation/sensation on the two-level scale of:
  – “Yes, I feel as though I have laryngeal irritation/sensation”
  – “No, I don’t feel as though I have laryngeal irritation/sensation”
Methods

• The mucus aggregation was rated from endoscopy recordings by two trained, reliable judges on the following scales:
  – Type (Types 1, 2, 3)
  – Pooling (not apparent, mild, severe)
  – Thickness (not apparent, mild, severe)
  – Location (anterior, medial, posterior)

(Bonilha et al, 2008; Hsiao et al, 2002; & Hsuing, 2004)
Mucus Ratings
Results: Mucus Presence

- In persons with and without voice disorders, mucus was present in 100% of cases
Results: Sensation Presence

• Sensation was present in:
  – 71% of vocally-normal subjects &
  – 68% of subjects with voice disorders
## Results: Sensation & Mucus Presence

<table>
<thead>
<tr>
<th></th>
<th>Mucus +</th>
<th>Mucus -</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal Sensation +</td>
<td>32</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>Laryngeal Sensation -</td>
<td>14</td>
<td>0</td>
<td>14</td>
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</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Sensitivity: 32/46 = 0.70</td>
<td>PPV: 32/32 = 1.00</td>
<td></td>
</tr>
<tr>
<td>Specificity: 0/0 = 0.00</td>
<td>NPV: 0/14 = 0.00</td>
<td></td>
</tr>
</tbody>
</table>
## Results: Mucus Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Vocally-Normal</th>
<th>Voice Disordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>88%</td>
<td>86%</td>
</tr>
<tr>
<td>Type 2</td>
<td>100%</td>
<td>77%</td>
</tr>
<tr>
<td>Type 3</td>
<td>58%</td>
<td>77%</td>
</tr>
</tbody>
</table>
## Results: Mucus Type

<table>
<thead>
<tr>
<th></th>
<th>Vocally-Normal</th>
<th>Voice Disordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>88%</td>
<td>86%</td>
</tr>
<tr>
<td>Type 2</td>
<td>100%</td>
<td>77%</td>
</tr>
<tr>
<td>Type 3</td>
<td>58%</td>
<td>77%</td>
</tr>
</tbody>
</table>
# Results: Mucus Type 1

<table>
<thead>
<tr>
<th></th>
<th>Vocally-Normal</th>
<th>Voice Disordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation Present</td>
<td>71%</td>
<td>68%</td>
</tr>
<tr>
<td>Type 1 Present</td>
<td>88%</td>
<td>86%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Type 1 +</th>
<th>Type 1 -</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal Sensation +</td>
<td>28</td>
<td>4</td>
<td>32</td>
</tr>
<tr>
<td>Laryngeal Sensation -</td>
<td>12</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>6</td>
<td>46</td>
</tr>
</tbody>
</table>

- Sensitivity: $\frac{28}{40} = 0.70$
- Specificity: $\frac{2}{6} = 0.33$
- Positive Predictive Value (PPV): $\frac{28}{32} = 0.88$
- Negative Predictive Value (NPV): $\frac{2}{14} = 0.14$
Results: Mucus Type 2

<table>
<thead>
<tr>
<th></th>
<th>Vocally-Normal</th>
<th>Voice Disordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation Present</td>
<td>71%</td>
<td>68%</td>
</tr>
<tr>
<td>Type 2 Present</td>
<td>100%</td>
<td>77%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Type 2 +</th>
<th>Type 2 -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal Sensation +</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>Laryngeal Sensation -</td>
<td>11</td>
<td>3</td>
</tr>
</tbody>
</table>

Sensitivity: 30/41 = 0.73
Specificity: 2/5 = 0.40
PPV: 30/32 = 0.94
NPV: 3/15 = 0.20
## Results: Mucus Type 3

<table>
<thead>
<tr>
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<th>Vocally-Normal</th>
<th>Voice Disordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation Present</td>
<td>71%</td>
<td>68%</td>
</tr>
<tr>
<td>Type 3 Present</td>
<td>58%</td>
<td>77%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Type 3 +</th>
<th>Type 3 -</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal Sensation +</td>
<td>23</td>
<td>9</td>
<td>32</td>
</tr>
<tr>
<td>Laryngeal Sensation -</td>
<td>8</td>
<td>6</td>
<td>14</td>
</tr>
</tbody>
</table>

- Sensitivity: $\frac{23}{31} = 0.74$  
- Specificity: $\frac{6}{15} = 0.40$  
- PPV: $\frac{23}{32} = 0.72$  
- NPV: $\frac{6}{14} = 0.43$
Results: Mucus Thickness

- Ratings of severely thick mucus corresponded to ratings of laryngeal sensation in 63% of cases

<table>
<thead>
<tr>
<th></th>
<th>Vocally-Normal</th>
<th>Voice Disordered</th>
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</thead>
<tbody>
<tr>
<td>Sensation Present</td>
<td>71%</td>
<td>68%</td>
</tr>
<tr>
<td>Mild Thickness Present</td>
<td>4%</td>
<td>18%</td>
</tr>
<tr>
<td>Severe Thickness Present</td>
<td>96%</td>
<td>82%</td>
</tr>
</tbody>
</table>
# Results: Mild Mucus Thickness

<table>
<thead>
<tr>
<th></th>
<th>Vocally-Normal</th>
<th>Voice Disordered</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensation Present</strong></td>
<td>71%</td>
<td>68%</td>
</tr>
<tr>
<td><strong>Mild Pooling Present</strong></td>
<td>4%</td>
<td>18%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Mild Thickness +</th>
<th>Mild Thickness-</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Laryngeal Sensation +</strong></td>
<td>3</td>
<td>29</td>
</tr>
<tr>
<td><strong>Laryngeal Sensation -</strong></td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>41</td>
</tr>
</tbody>
</table>

Sensitivity: $\frac{3}{5} = 0.60$  
Specificity: $\frac{12}{41} = 0.29$  
PPV: $\frac{3}{32} = 0.09$  
NPV: $\frac{12}{14} = 0.86$
### Results: Severe Mucus Thickness

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Sensation Present</td>
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</tr>
<tr>
<td>Severe Pooling Present</td>
<td>96%</td>
<td>82%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Severe Thickness +</th>
<th>Severe Thickness -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal Sensation +</td>
<td>29</td>
<td>3</td>
</tr>
<tr>
<td>Laryngeal Sensation -</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>41</td>
<td>5</td>
</tr>
</tbody>
</table>

- Sensitivity: \( \frac{28}{41} = 0.68 \)
- PPV: \( \frac{29}{32} = 0.91 \)
- Specificity: \( \frac{2}{5} = 0.40 \)
- NPV: \( \frac{2}{14} = 0.14 \)
Results: Mucus Pooling

- Ratings of severe mucus *pooling* corresponded to ratings of laryngeal sensation in 68% of cases

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<tbody>
<tr>
<td>Sensation Present</td>
<td>71%</td>
<td>68%</td>
</tr>
<tr>
<td>Mild Pooling Present</td>
<td>21%</td>
<td>27%</td>
</tr>
<tr>
<td>Severe Pooling Present</td>
<td>79%</td>
<td>73%</td>
</tr>
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</table>
## Results: Mild Mucus Pooling

<table>
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<tr>
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<tr>
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<td>68%</td>
</tr>
<tr>
<td>Mild Pooling Present</td>
<td>21%</td>
<td>27%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Mild Pooling +</th>
<th>Mild Pooling -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal Sensation +</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>Laryngeal Sensation -</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Sensitivity: 7/11 = 0.64</td>
<td>PPV: 7/32 = 0.22</td>
<td></td>
</tr>
<tr>
<td>Specificity: 10/35 = 0.29</td>
<td>NPV: 10/14 = 0.71</td>
<td></td>
</tr>
</tbody>
</table>
Results: Severe Mucus Pooling

<table>
<thead>
<tr>
<th></th>
<th>Vocally-Normal</th>
<th>Voice Disordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation Present</td>
<td>71%</td>
<td>68%</td>
</tr>
<tr>
<td>Severe Pooling Present</td>
<td>79%</td>
<td>73%</td>
</tr>
</tbody>
</table>

Sensitivity: \( \frac{25}{35} = 0.71 \)  
Specificity: \( \frac{4}{11} = 0.36 \)  
PPV: \( \frac{25}{32} = 0.78 \)  
NPV: \( \frac{4}{14} = 0.29 \)

<table>
<thead>
<tr>
<th></th>
<th>Severe Pooling +</th>
<th>Severe Pooling -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal Sensation +</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td>Laryngeal Sensation -</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>11</td>
</tr>
</tbody>
</table>
Results: Mucus Location

Mucus *location* corresponded with complaints of an irritating laryngeal sensation in ...

- anterior - 50%, medial - 47%, posterior - 52%

<table>
<thead>
<tr>
<th></th>
<th>Vocally-Normal</th>
<th>Voice Disordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation Present</td>
<td>71%</td>
<td>68%</td>
</tr>
<tr>
<td>Anterior Mucus Present</td>
<td>92%</td>
<td>96%</td>
</tr>
<tr>
<td>Medial Mucus Present</td>
<td>100%</td>
<td>96%</td>
</tr>
<tr>
<td>Posterior Mucus Present</td>
<td>88%</td>
<td>96%</td>
</tr>
</tbody>
</table>
## Results: Anterior Mucus

<table>
<thead>
<tr>
<th></th>
<th>Vocally-Normal</th>
<th>Voice Disordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation Present</td>
<td>71%</td>
<td>68%</td>
</tr>
<tr>
<td>Anterior Mucus Present</td>
<td>92%</td>
<td>96%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Anterior Mucus +</th>
<th>Anterior Mucus -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal Sensation +</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>Laryngeal Sensation -</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>43</td>
<td>3</td>
</tr>
</tbody>
</table>

- Sensitivity: $\frac{30}{43} = 0.70$
- PPV: $\frac{30}{32} = 0.94$
- Specificity: $\frac{1}{3} = 0.33$
- NPV: $\frac{1}{14} = 0.07$
Results: Medial Mucus

<table>
<thead>
<tr>
<th></th>
<th>Vocally-Normal</th>
<th>Voice Disordered</th>
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</thead>
<tbody>
<tr>
<td>Sensation Present</td>
<td>71%</td>
<td>68%</td>
</tr>
<tr>
<td>Medial Mucus Present</td>
<td>100%</td>
<td>96%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Medial Mucus +</th>
<th>Medial Mucus -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal Sensation +</td>
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<tr>
<td>Laryngeal Sensation -</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>1</td>
</tr>
</tbody>
</table>

Sensitivity: 32/45 = 0.71  PPV: 32/32 = 1.0
Specificity: 1/1 = 1.0    NPV: 1/14 = 0.07
## Results: Posterior Mucus

<table>
<thead>
<tr>
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<th>Vocally-Normal</th>
<th>Voice Disordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation Present</td>
<td>71%</td>
<td>68%</td>
</tr>
<tr>
<td>Posterior Mucus Present</td>
<td>88%</td>
<td>96%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Posterior Mucus +</th>
<th>Posterior Mucus -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal Sensation +</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>Laryngeal Sensation -</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>4</td>
</tr>
</tbody>
</table>

Sensitivity: \( \frac{30}{42} = 0.71 \)  
PPV: \( \frac{30}{32} = 0.94 \)  
Specificity: \( \frac{2}{4} = 0.50 \)  
NPV: \( \frac{2}{14} = 0.14 \)
Results

• In persons with and without voice disorders, mucus was present in 100% of cases.

• Sensation was present in 71% of vocally-normal subjects and 68% of subjects with voice disorders.
Results

Persons who reported laryngeal sensation had mucus that was rated as:

• Type 1 in 88% of cases
• Type 2 in 94% of cases
• Type 3 in 72% of cases

• Anterior in 94% of cases
• Medial in 100% of cases
• Posterior in 94% of cases

• Mildly thick in 9% of cases
• Severely thick in 91% of cases

• Mild pooling in 22% of cases
• Severe pooling in 78% of cases
Results

Persons who reported laryngeal sensation had mucus that was rated as:

- Type 1 in 88% of cases
- Type 2 in 94% of cases
- Type 3 in 72% of cases
- Anterior in 94% of cases
- Medial in 100% of cases
- Posterior in 94% of cases
- Mild pooling in 22% of cases
- Severe pooling in 78% of cases
- Mildly thick in 9% of cases
- Severely thick in 91% of cases
Discussion

• Persons with and without a voice disorder report laryngeal sensation

• Persons with and without voice disorders present with different types of mucus aggregation
Discussion

• This study did not find that the presence of an irritating laryngeal sensation is predictive of the presence of mucus either in persons with and without voice disorders
  – Presence of mucus aggregation - 100%
  – Reported laryngeal - ~70%
Discussion

• Patient report of laryngeal sensation is not sensitive to detecting mucus.

• But, the results did indicate that report of laryngeal sensation may be related to mucus thickness and pooling.
Discussion

• However, our small sample size of participants with mildly thick mucus and mild pooling prohibits the generalizability of this finding.

• Future studies should include measurements of laryngeal sensation along with patient reports and report on the influence of mucus aggregation on vocal fold vibration and voice quality.
Cycle

Cause of Sensation

Reaction to Cough

Temporary Sensation Relief

Sensation

Urge to Cough

Cough
Cycle

Cause of Sensation

Reaction to Cough

Temporary Sensation Relief

Cough

Urge to Cough

Sensation

No reaction allowed
Cycle

Cause of Sensation

Reaction to Cough

Sensation

Temporary Sensation Relief

Urge to Cough

Cough
Cycle

Cause of Sensation

Reaction to Cough

Temporary Sensation Relief

Sensation

Urge to Cough

Cough

Temporary Sensation Relief

Reaction to Cough

Cause of Sensation

Cough
THANK YOU!

This work was supported by ...

R03 DC008403 NIH/NIDCD
KL2 UL1 RR029880 NIH/NCRR


Globus

• A choking sensation
  – Harar, 2008

• The feeling of a lump in the throat
  – Bauza, 2008; Khalil, 2008

• Many times appears to have no anatomical reason
  – Khalil, 2008
Globus

• Today, Globus accounts for 3-4% of all new ENT referrals.
  – Karkos, 2008; Khalil, 2008; Maung, 2005
Globus

• Can affect up to 6% of the general population at any time.
  – Karkos, 2008
Globus

• It is thought to occur in 35% of men and over 50% of women.
  – Burns, 2008
Globus

• There have been studies that suggest organic causes of globus:
  – GERD & Laryngopharyngeal reflux (Khalil, 2008; Nadig, 2006)
  – enlarged thyroids (Burns, 2007)
  – laryngeal sensory neuropathy (Khalil, 2008)
  – tumors and cysts (Nadig, 2006)
  – abnormalities at the base of the tongue. (Bauza, 2008)
Globus

• Whether or not these various disorders and anatomical abnormalities are actually *causes* or just *associations* of globus remains a mystery.
  – Khalil, 2008
Globus

• Many people believe that the sensation is due to purely psychological reasons

• Some studies confirm the possibility that Globus can result from stress and life hassles.
  – Deary, 1992; Harris, 1996
Mucus
Mucus

- Produced by mucous membranes and mixed glands

- Role – protect epithelial cells

- Laryngeal gland secretions, mucociliary clearance, and vocal epithelial cells determine the depth and composition of surface liquid
Mucus

• There is support for the hypothesis of a direct relationship between inflammation and mucus

• Eosinophils (white blood cells that are part of the immune system) which are positively charged interact with negatively charged mucin molecules
Mucus

• It is believed that these inflammatory cells have a direct role in the production and release of mucus

• And they may increase viscosity, adhesivity, and surface tension of the secretions
Definition

Globus - Latin for ball - describes the sensation of something in the throat. Globus pharyngis - ball in the throat - is the name given to the condition when this is the major symptom and no other serious abnormality is found. The terms are however often used loosely and interchangeably.

http://www.entassociates.com/post_nasal_drip.htm
2. Thick Mucus

Increasing your water intake, as outlined above, will frequently help take care of problems with thick mucus. Sometimes, your doctor will prescribe a mucolytic drug to help thin the mucus. The most common mucolytic is Humibid LA (generic name: guaifenesin). You must drink 6 to 8 glasses of water per day for this medication to have significant effects. In most cases, this will adequately thin the mucus. Despite these measures, some people continue to have the sensation of thick mucus in their throat or on their vocal cords. In many instances, this is due to backflow of stomach acid into the throat—so called gastroesophageal reflux disease, or GERD. This is discussed in detail in another handout.

**Is there actually mucus in the throat when clearing takes place?**

Yes, definitely. The mucous is there, and when the chronic throat clearing expels it into the mouth (where it is swallowed), or if the clearing is especially vigorous, into the air. The mucous is whiteish or slightly yellowish, and is not infected nor bloody; it is in fact normal mucous that everyone has in their airways. The chronic throat clearing produces more mucous than is normal and/or feels the mucous more heavily in his throat than is normal, and then has an uncontrollable urge to clear it.

Frequently, a patient with vocal cord swelling from a cold, allergies, and/or GERD (reflux), will get embroiled in a vicious cycle which prevents the swelling from going down. It will feel like there is mucus or the sensation of having something in your throat, when in reality, the vocal cords are only swollen. That’s why your problem keeps getting worse; you haven’t broken the cycle. The cycle needs to be broken so healing can occur.

**Tech Therapy’ if the problem is throat clearing?**

One of the most frequent causes for throat clearing and coughing is when dryness) or too much mucus (as with a cold) on or below the vocal folds. To clear mucus is by using a productive cough where there is high air flow achieved by using the following procedure: take in as deep a breath as possible, push the chest and abdomen inward with as much strength as is "H" sound while you expel the air.

**Mucus Production**

Mucus is generally produced by the cells lining the sinuses passages. On average, the body produces 1 to 2 quarts of mucus a day. This should keep the nasal membranes moist and capable of humidifying the air that is sucked into the body. Mucus also aids in the fight against irritants and infections. So where exactly does dripping mucus go? The answer is mostly in the throat. Mucus in the throat is what gives you the feeling of having constant phlegm. But how exactly does the mucus reach the throat?
Tab. 1. Summary of Davenport Urge to Cough Model and its application to the cough.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Application to Management of cough</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Stimulus</td>
<td>Trigger for neural event</td>
<td>Understand exposure to cough triggers</td>
</tr>
<tr>
<td>2. Urge</td>
<td>Physical need to respond to stimuli</td>
<td>Determine whether exposure to triggers results in cough or urge to cough</td>
</tr>
<tr>
<td>3. Desire</td>
<td>Transition of urge into central neural targeted goal</td>
<td>Warning before cough</td>
</tr>
<tr>
<td>4. Action</td>
<td>Physical response that satisfies urge-desire</td>
<td>Rate urge to cough during cough challenge tests</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Deliberate outcome</td>
</tr>
</tbody>
</table>

**The Throat Itch?**

The Walls of the throat are covered with mucosal membrane containing nerves, which sends impulses to various airways, thus protecting them and allowing smooth passage of air and food. Mucous glands in the throat walls, thus protecting them and allowing smooth passage of air and food. Mucous glands do not secrete enough mucus, for example, due to dry air, throat nerves become exposed and irritable.

<table>
<thead>
<tr>
<th>3. Desire</th>
<th>Person perceives need to clear irritation from airway</th>
<th>Desire to cough to open airway</th>
<th>Person perceives need to cough</th>
<th>Person perceives need to clear irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Action</td>
<td>Cough</td>
<td>Cough → Vocal folds abduct and airway remains patent</td>
<td>Cough → Food dislodged from vocal folds</td>
<td>Cough which clears gastric contents from glottis The cough may stimulate more reflux</td>
</tr>
<tr>
<td>5. Evidence</td>
<td>Feedback that irritation is reduced</td>
<td>Feedback that airway patency has been restored</td>
<td>Feedback that material has been dislodged</td>
<td>Feedback that the laryngeal irritation is relieved</td>
</tr>
</tbody>
</table>
Significance

• 4,080,000 persons with voice disorders use habitual abusive clearing behaviors.

• These behaviors are considered one of the most prevalent forms of vocal abuse.
Significance

• The reported cause of their clearing is typically an irritating laryngeal sensation attributed to mucus aggregation.

• Reported laryngeal sensations range from burning or pain to an irritating tickle.
Significance

• Chronic coughing and throat clearing ...

  – Are a causal factor in vocal trauma
  – Impede behavioral voice therapy efforts
  – Diminish surgical treatment results
  – Impact patient’s life
Significance

• SLPs and ENTs rely on patient report of irritating sensations of mucus.

• However, we do not understand the physiological link between reported mucus sensation and actual mucus aggregation.
Research Questions

• What is the relationship between patient reports of laryngeal mucus and actual presence of mucus on the vocal folds?
Why care about laryngeal sensation?

- Frequent complaint

- Commonly related to abnormal mucus aggregation

- Part of the suggested loop of chronic coughing and throat clearing which have themselves been assumed to be harmful to the vocal fold mucosa
Laryngeal Sensations
Mucus
Coughing and Throat Clearing
In other words…

• Growing up, I didn’t dream of studying mucus, but my colleagues and I frequently deal with mucus and mucus-related issues (patient complaint of laryngeal sensation and coughing/throat clearing)

• In particular, I want to improve our assessment and treatment of persons with chronic cough and throat clearing
Understanding the Cycle

• It is difficult to understand and evaluate the cycle because we do not have good measures for:
  – Laryngeal sensation
  – Mucus
  – Or Cough and clearing
• This is the first study to determine the relationship between patient reports of laryngeal mucus and actual presence of mucus on the vocal folds.
Conclusion

• The outcomes of this study, if found to be generalizable, have clinical implications for the use of patient report of sensation in diagnosis-and treatment-decision making